TELEDYNE
CONTINENTAL MOTORS

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COLLECTION AND ASSESSMENT OF AIRCRAFT EMISSIONS

FINAL REPORT

BY:
JOSE F. REGUERIRO

ENVIRONMENTAL PROTECTION AGENCY
CONTRACT 68-04-0035

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Five engines each of four different models of aircraft piston engines manufactured by Teledyne Continental Motors were tested for gaseous emissions (NO, HC, and CO). All of the engines were new engines. The engine models tested were: 0-200-A, 0-470-R, IO-520-D, and GT-510-520-H. In addition, two tests were performed to determine the effect of installing the sample probe in different locations. One test was conducted to determine the effects of various air/fuel ratio settings on an engine at take-off power.

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FOREWORD

This Teledyne Continental Motors Report No. 635, documents the results of a 4-1/2 month research study of aircraft engine emissions to determine the pollution levels at various engine operational conditions. The work performed under the direction of the Environmental Protection Agency, under Contract 68-04-0035.

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SECTION 1
SUMMARY

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SECTION 1 - SUMMARY

Five engines each of four different models of aircraft engines manufactured by Teledyne Continental Motors were tested for gaseous emissions (NO, HC, and CO). All of these engines, except one GTSIO-520-H (S/N188284), were new engines, with only the "Green Run" having been performed. Total time on these engines was less than five hours.

A total of 43 tests were performed following a 13 mode test cycle. The engine models and number of tests per model were as follows:

0-200-A	9 Tests
0-470-R	11 Tests
IO-520-D	10 Tests
GTSIO-520-H	13 Tests

In addition, two tests were performed to determine the effect of installing the sample probe in different locations. One test was conducted to determine the effects of various air/fuel ratio settings (power, fuel consumption, emissions, temperatures) on an engine at take-off power.

A 13 mode test cycle was adopted as representative of a standard flight. The following modes were considered:

1. Cold Start
2. Idle - Taxi - Low
3. Idle - Taxi - High
4. Run-Up
5. Acceleration to 100% Power (Transition)
6. Full Power Take-Off
7. Take-Off to Climb (Transition)
8. Climb Rich - 75% Power (100% For 0-200-A)
9. Climb Lean - 75% Power
10. Pattern - 40% Power

11. Idle - Taxi

12. Shutdown (Transition)

13. Hot Start (After 5 minute "soak")

From the above test, it was soon determined that bank-to-bank emission levels were consistent, and the probe location was left as intended, 3 feet downstream of the last cylinder port in the particular bank being measured. For the turbocharged GTSIO-520-H, a location 3 feet downstream from the turbine discharge was standarized.

Transition mode mass emissions (Modes 5, 7 and 12) were determined impossible to evaluate quantitatively using continuous sampling techniques. Considering the low time-percentage employed in these modes, further readings were discontinued after enough information was obtained to establish transient mode trends.

Table 1. 1 indicates the time in each mode for a particular engine model and the time percentage (hereinafter referred to as Weight Factor-WF).

TABLE 1. 1

AVERAGE FLIGHT CYCLE
ENGINE TIME IN MINUTES AND WEIGHT FACTORS ARRIVED AT
AFTER INCORPORATION OF LOW-TIME TRANSIENT MODES INTO ADJACENT MODES

	O-200-A & O-470-R				IO-520-D & GTSIO-520-H				
	TIME	%	TIME	% WF	TIME	%	TIME	% WF	FINAL MODE NUMBER
MODE	1	2	3	4	1	2	3	4	
1 COLD START	1.00	4.47	1.00	4.47	2.00	8.16	2.00	8.16	1
2 IDLE-TAXI-LOW	2.00	8.95	2.00	8.95	2.00	8.16	2.00	8.16	2
3 IDLE-TAXI-HIGH	3.00	13.42	3.00	13.42	3.00	12.24	3.00	12.24	3
4 RUN-UP	1.00	4.47	1.00	4.47	2.00	8.16	2.00	8.16	4
5 ACCELERATION	.05	.22	——	——	.07	.29	——	——	——
6 TAKE-OFF	.25	1.12	.30	1.34	.35	1.43	.42	1.72	5
7 T. O. TO CLIMB	——	——	——	——	.03	.12	——	——	——
8 CLIMB-RICH	6.00	28.65	6.00	28.65	3.00	12.24	3.03	12.37	6
9 CLIMB-LEAN	——	——	——	——	3.00	12.24	3.00	12.24	7
10 PATTERN	6.00	28.65	6.00	28.65	6.00	24.49	6.00	24.49	8
11 IDLE-TAXI	3.00	13.42	3.05	13.64	3.00	12.24	3.05	12.45	9
12 SHUTDOWN	.05	.22	——	——	.05	.21	——	——	——
	22.35	99.99	22.35	99.99	24.50	99.98	24.50	99.99	

1 TIME ON EACH MODE
2 TIME PERCENTAGE ON EACH MODE
3 TIME ON EACH MODE, AFTER REINCORPORATION OF LOW-TIME TRANSIENT MODES INTO ADJACENT MODES
4 TIME PERCENTAGE ON THE READJUSTED MODES, HEREINAFTER REFERRED TO AS WEIGHT FACTOR OR WF

Average weighted results for the different engine models are expressed in Table 1.2.

Table 1.2

Flight Cycle Mass Emissions Average Weighted Values

O-200-A Engine Model	NO_2	HC	CO	Total
gm/minute	.31	2.99	143	146
gm/cycle	7.02	66.9	3191	3265
gm/lb. fuel/cycle	.51	12.5	298	311
O-470-R Engine Model				
gm/minute	1.49	8.06	214	224
gm/cycle	33.4	180.0	4790	5003
gm/lb. fuel/cycle	1.34	22.6	292	316
IO-520-D Engine Model				
gm/minute	4.47	13.4	216	234
gm/cycle	99.8	300.0	4821	5221
gm/lb. fuel/cycle	3.09	36.7	249	289
GTSIO-520-H Engine Model				
gm/minute	3.98	7.18	450	461
gm/cycle	88.9	160.0	10,060	10,309
gm/lb. fuel/cycle	2.23	10.5	331	344

Analysis of weighted mass emissions over the adopted cycle (Table 9.39) shows that climb (rich and lean) and pattern modes contribute over 85 percent of the NO_2 mass emissions. The mass emissions of HC are significant at all load points, and over 75 percent of the CO emissions can be accounted for in the climb and pattern modes.

A comparison of all engines of the basis of true brake specific mass emissions (gm/BHP-Hr.), not weighted, on the high load points, is included in Table 1.3. A brake specific mass emission evaluation of the low load points was not felt to be meaningful because of the many variables involved. The takeoff point is, after weighting, of such low importance that it is not considered in Table 1.3.

Table 1.3

Unweighed Brake Specific Mass Emissions, gm/BHP-Hr.

O-200-A Engine Model	A/F Ratio	NO$_2$	HC$_T$	CO
Climb-Rich	10.83	.59	3.6	228
Pattern	9.41	.20	4.2	174
O-47-R Engine Model				
Climb-Rich	11.81	1.59	2.5	160
Pattern	11.22	.90	4.4	211
IO-520-D Engine Model				
Climb-Rich	10.39	1.15	3.7	193
Climb-Lean	12.90	8.67	2.3	46
Pattern	8.69	.54	20	389
GTSIO-520-H Engine Model				
Climb-Rich	10.67	.72	2.0	254
Climb-Lean	12.72	3.77	1.9	115
Pattern	11.30	1.89	2.1	192

Transient modes were evaluated qualitatively by reviewing transient NO and CO traces. With the exception of brief excursions of traces due to instantaneous air/fuel ratio variations, the inflight and takeoff transients can be approximated by a mean average of the end points. In the case of the cold start, a point two minutes after starting was considered as "average."

A special series of tests was conducted with the GTSIO-520-H engine to gain some insight into possible future approaches to reduce exhaust emissions. Tests were conducted at each mode (except full rich takeoff, full rich climb, and leaned out climb), both at full rich and "best power" settings. At the light load points, the results show considerable scatter, due to the many operating variables involved. Fairly consistent results were obtained on the pattern mode and are presented in Table 1.4 (condensed from 9.36).

Table 1.4

Exhaust Emissions as a Function of A/F Ratio.
Mass Emissions (gm/Hr) and Brake Specific Mass Emissions (gm/BHP-Hr) during Pattern Mode with GTSIO-520 Engines.

Condition		A/F	NO2		HC		CO	
			(1)	(2)	(1)	(2)	(1)	(2)
Full Rich Setting	(3)	10.64	129	.76	406	2.37	42982	251
Best Power Setting	(4)	12.37	649	3.70	281	1.60	17319	98
Totals	(5)	11.30	330	1.89	358	207	33111	192

(1) gm/Hr.
(2) gm/BHP-Hr.
(3) Average of 8 Runs
(4) Average of 5 Runs
(5) Average of All 13 Runs

SECTION 2 - CONCLUSIONS

2.1 The differences between samples taken from each bank of the 0-200-A engine result from different A/F ratios and power levels, and are well within the range of instrument variance and engine operating variables, (Test 4-1-4).

2.2 Differences in samples taken at the turbine exhaust and waste gate exhaust with one GTSIO-520-H engine (Test 41-3-2) are very small and well within the normal spread attributable to variables in engine and equipment operation.

2.3 Because of the varying response times of the instrumentation, only qualitative evaluations of the transient modes is possible using a continuous sampling technique.

2.4 Transient mode emissions contribute little compared to the total cycle emissions.

2.5 Over 75 percent of NO and CO emissions are produced in the climb and pattern modes.

2.6 Mass emission levels of hydrocarbons were significant in all modes.

SECTION 3 - RECOMMENDATIONS

3.1 Evaluation of Aircraft Piston Engine Exhaust Emissions should be based on only steady state engine operating modes.

3.2 Transient modes should not be considered.

SECTION 4 - DISCUSSION

4.1 Basic Considerations Regarding Emissions From Throttled Gasoline (Otto) Engines

Mass emissions from any type of powerplant are a function of the pollutant concentration and the exhaust mass flow rate. With the Otto engine, this second term is a direct function of engine speed and indicated load. This general statement can be represented by the equation:

$$\text{Mass Emissions (gm/Hr)} = f\,(\text{Conc} \times \text{RPM} \times \text{Load}) \qquad \text{(a)}$$

Nitrous Oxides Mass Emissions:

NO concentration is load dependent for a constant A/F ratio. For a constant load, with A/F ratios below stoichiometric, the concentration increases with the A/F ratio. In broad terms, equation (a) could be rewritten:

$$NO_2\ \text{(gm/Hr)} = f\,(A/F \times \text{RPM} \times \text{Load}^x) \qquad \text{(b)}$$

with Exponent (x) being larger than 1. This term varies with engine design.

Equation (b) only applies for A/F Ratios richer than stoichiometric.

Unburned Hydrocarbons:

The concentration depends on A/F Ratio. For mixtures richer than stoichiometric, the concentration is inversely proportional to A/F Ratio. For any given A/F Ratio, the concentration is inversely proportional to load (higher load = higher cylinder wall temperatures = reduced unburned hydrocarbons). A general hydrocarbon mass emission equation can be written:

$$HC\ \text{(gm/Hr.)} = f\,(\frac{F}{A} \times \text{RPM} \times \text{Load}^y) \qquad \text{(c)}$$

with Exponent (y) being somewhat less than unity. This exponent is dependent on engine design.

Carbon Monoxide:

The concentration is inversely proportional to A/F Ratio, for mixtures richer than stoichiometric. For a constant A/F Ratio, the concentration is not load sensitive. The general formula can be rewritten:

$$CO\ (gm/Hr.) = f\ (\frac{F}{A} \times RPM \times Load)$$

From the above considerations, a general conclusion can be drawn for emissions from a throttled gasoline engine:

Low Speed, Light Load Mass Emissions for NO_2, HC, and CO (gm/Hr.) are in General, and Within Reasonable Ranges of A/F Ratios, Only a Very Small Part of the High Speed - High Load Emissions Rates.

4.2 Transient Conditions

4.2.1 Cold Start:

To obtain a proper evaluation of the emissions impact of an engine under starting conditions, the general statement made in Paragraph 4.1 above must be kept in perspective. From Table 1.1, the cold start mode averages a maximum of 8.2 percent of the cycle time. Even with the very rich A/F Ratios used for starting, the overall (weighted) emissions impact of this mode is no more than 10 percent of the total cycle emissions (see Table 9.39).

In an attempt to time correlate emissions during cold start, some tests were performed with the 0-200's and 0-470's, whereby emissions readings were taken at 10, 70, 130 and 190 seconds after start-up (Tests 5-1-5 to 12-2-2). From these tests, NO and CO levels remain basically unchanged. Test 7-2-1 shows a 40 percent reduction in hydrocarbons after three minutes, if the engine fires consistently. Figure 9.2 in Section 9 shows the results of this test. If the engine misses, the HC levels behave erratically, apart from being quite high due to the raw fuel being sucked by the FID from the exhaust stream. The line "hang-up" due to this occurrence invalidates all data taken under missing conditions. Taking all of these factors into consideration, for the rest of the tests only one reading was taken, two minutes after start-up. This was considered an accurate average point.

4.2.2 Acceleration and Take-Off to Climb:

From a practical standpoint, these two modes can be discounted because of the very low time element involved (2 to 4 seconds each per cycle). From Table 1.1, the time percentage for each is from one tenth to three tenths of one percent. Total mass emissions from the two modes combined, for any one engine, would not be more then 1 or 1.5 percent of the total cycle mass emissions. On the other hand, because of the slow instrument responses and the different response times, coupled to the inability to relate concentration values to speed, torque, air consumption and fuel consumption, a proper evaluation is determined impossible with the present techiniques. An attempt was made, however, to study the events taking place. Figures 9.3 and 9.4 show CO and NO concentration traces during the acceleration mode (#5). From Figure 9.3 it is interesting to note that the shape of the transient traces during tests 6-1-6 and 7-2-1 are very similar, even if they were obtained with different engines.

The traces from test 8-2-2 also resemble those already mentioned, but the trace from 5-1-5 is different. Some correlation may be obtained between CO (A/F Ratio) and NO from these traces, with NO sharply increasing or decreasing with increases or decreases in CO (obviously from instantaneous lean or rich mixtures, respectively). The shape of these sharp peaks (or absence of, like in 5-1-5) is directly related to the manner in which the operator moved the throttle lever, and the carburetor characteristics. Smooth movement of the lever should result in a smooth trace (5-1-5). A quick jab of the lever could be envisioned as the reason for the jagged traces from 6-1-6, 7-2-1 and 8-2-2.

An analysis of the traces in Figure 9.4 also show the ups and downs for Test 10-1-2 that were explained above. Test 9-1-1 shows the same pattern but with larger peak to peak values. Since this engine is fuel injected, the momentarily leaner mixture causing the increase in NO and the decrease in CO could be due to a short time lag between the opening of the throttle and the final increased fuel delivery. This system does not have the "accelerating pump" found in conventional carburetors.

In general, as already explained, these instantaneous variations in concentration cannot be related to instantaneous variations in air flow through the engine. Only the concentration is known, but not the emissions mass flow rate. On this basis, applying good judgment of engine and emissions behavior, the best evaluation would be to say that the mass emission levels are no higher than any of the end conditions bracketing the transient and more like an average between said end conditions.

4.2.3 Shutdown:

The same technical (instrumental) considerations applied to 4.2.2 can also be applied here. In addition, a measuring problem is presented by the unburned hydrocarbons laying in the exhaust system which continue showing an instrument reading long after the engine is down. For the above reasons, evaluation using continuous sampling techniques is not possible, and the statement regarding the possibility of mass emissions levels being somewhat in between the two end conditions does not apply either. Analyzing the true events, however, shows NO and CO go to zero at ignition cut-off, with a few grams of HC remaining (raw fuel) and finally being evaporated over a period of time (engine heat and fresh air entering the exhaust system). In general, because of the fuel cut off capabilities of the system, the events involved contribute no more to the airport pollution problem than a few drops of fuel spilled on a runway.

4.2.4 Hot Start:

Operation is not greatly different than cold start. CO and HC depend on A/F Ratio and engine operation. No changes in NO levels could be observed. This mode was maintained through all tests. Results are tabulated in the data sheets and results summaries (Sections 9 and 10) but not included in Tables 9.39 and 9.40 because of the similarity to the cold start, the low importance of the problem, and the fact that a hot start was not considered to be a part of the hypothetical cycle.

An observation is due here regarding the high hydrocarbon concentration levels observed during some runs, especially the cold and hot starts. The engines tested (with one exception) were all new with only the "green run" time on them. With the heated FID and heated sample line used for this project, the total hydrocarbons measured also include the "heavy" hydrocarbon ends resulting from consumption of the lubricating oil that would have gone undetected if NDIR or unheated FID had been used for analyzers. A study of the relative contribution of lubricating oil consumption to the unburned hydrocarbons during the cycle is beyond the scope of this project.

4.3 Instrumentation

A few words are in order here regarding instrumentation and reading accuracy. Analysis of the data shows scatter of the results. This scatter could be due either to instrument and operational errors or to the multitude of variables affecting engine operation (atmospheric temperature, pressure, humidity, A/F Ratio, torque, RPM, engine friction and oil consumption, small timing variations, etc.). Close examination of the results under high load conditions, when the effects of the second set of variables on the engine would be minimal, shows much greater consistency and little scatter. The curves in Figure 9.1, plotted from run #43-5-2, are smooth with little scatter between points.

Figure 9.5 has been plotted as an extra aid in defining possible instrument and operational errors. Since mass emissions are calculated from five different readings (concentration, torque, engine speed, air flow, fuel flow) plotted against A/F ratio (resulting from two readings), the 14.9 percent maximum average deflection is well within acceptable limits. Eliminating eight outlying points out of a total of 37, the remaining 29 (78.4 percent) show an average deviation of only 2.6 percent, with a maximum average deviation in any single curve (NO_2) of 4.5 percent. This analysis establishes the high level of instrument and operational accuracy at high load, where the effects of uncontrolled variables on engine operation and emissions characteristics are minimal. On this basis, data scatter at light load must then be tied to the effect of operational variables affecting exhaust emissions, and not to instrument or operational errors.

A cross reference check of Teledyne Continental's instrumentation was conducted by Environmental Protection Agency. A series of unknown gases were analyzed by Scott Laboratories, E.P.A., and TCM. The results of this exercise, as reported by E.P.A., appear in tabulated form as Table B-1 of Appendix "B".

A picture of the emissions instrumentation is also included as Figure 6.1 of Section 6.

SECTION 5 - ENGINE DATA

	O-200-A	O-470-R	IO-520-D	GTSIO-520-H
Number of Cylinders	4	6	6	6
Bore	4-1/16	5	5-1/4	5-1/4
Stroke	3-7/8	4	4	4
Compression Ratio	7.0:1	7.0:1	8.5:1	7.5:1
Piston Displacement (In^3)	201	471	520	520
Rated Power (Sea Level)	100	230	300	375
Rated RPM	2750	2600	2850	3400
Induction System	N. A.	N. A.	N. A.	Turbocharged
Fuel System	Carbureted	Carbureted	Fuel Inj.	Fuel Inj.
Propeller Drive	Direct	Direct	Direct	Gear Reduction

SECTION 6 - EQUIPMENT AND INSTRUMENTATION

6.1 Engines:

Model	S/N
O-200-A	213451 213504 213483 213500 213474
O-470-R	211305 211302 211280 211317 211333
IO-520-D	159850 159977 159982 159983 159987
GTSIO-520-H	188284 210206 210219 210221 210212

6.2 Engine Testing Equipment

Engine Test Cell #23 was used with the following equipment:

1. Standard Electric Time Co. Chronotachometer, Type SG,
   S/N 5745

2. Honeywell Electronic 15 Brown Potentiometer
   Model No. 15618836-48-01-1-000-061-060-168-203
   S/N C8203425001

3. Fischer Porter Rotameters
   S/N 5706-A2106-A6, Range 4-20 Lbs/Hr.
   S/N 6406-A2112-A4, Range 30-330 Lbs/Hr.

4. Ashcroft Duragauge 0-200 psi, No Model or S/N

5. Ashcroft Duragauge 0-60 psi, No Model or S/N

6. Garwin Gauge 2-20 psi, No Model or S/N

Engine Test Cell #24 was used with the following equipment:

7. Standard Electric Time Co. Chronotachometer, Type SG, S/N 6313

8. Honeywell Electronic 15 Brown Potentiometer
   Model No. 15618836-48-01-1-000-061-168-060
   S/N F9282948002

9. Fischer Porter Rotameters
   S/N 603-A3561-A6, Range 4-20 Lbs/Hr.
   S/N 735-P-E1-1699, Range 10-100 Lbs/Hr.
   S/N V-1399/2, Range 40-320 Lbs/Hr.

10. Leeds and Northrup Potentiometer
    Model No. 8694-2

11. High Temperature Thermocouples
    a) S/N 1774554
    b) S/N 1774557

12. Ashcroft Duragauge 0-200 psi, No model or S/N

13. Ashcroft Duragauge 0-60 psi, No model or S/N

14. Garwin Gauge 2-20 psi, No model or S/N

15. Lebow Associates Torquemeter
    Model No. 1308
    S/N 108

16. Lebow Associates Torque Digital Indicator
    Model No. 7510
    S/N 19

17. Lebow Associates Torquemeter
    Model No. 1308-12K
    S/N 119

18. Lebow Associates Torque Digital Indicator
    Model No. 666
    S/N 179

19. Meriam Laminar Flow Element
    Model No. 50MC2-6FS
    S/N E-18091

20. Meriam Inclinometer Type WM
    Model No. 442HE25
    S/N E-18092

21. Hartzell 3-Blade Ground Adjustable Propeller,
    Type HCA2XF, S/N 133
    Propeller Blade Type A-8433-36
    Propeller Blade S/N: A-22250 (Two other blades unreadable).

22. Hartzell 3-Blade Constant Speed, Adjustable Blade
    Angle Propeller, Model HCA3VF-2, S/N BL208
    Propeller Blade Design V8433-24
    Propeller Blade S/N: A39116, 115607 and 116124

23. Woodward Propeller Governor, P/N 210444, S/N 860934

6.3 Emissions Testing Equipment:

1. Scott Research Laboratories Test Console
   Model 107-2, S/N 6220, Push Type Sample Train,
   For Two Analyzers, Incorporating the following equipment:

   A. Beckman Model 315-A-S NDIR NO Analyzer
      Ranges: 1 - 0 to 4000 PPM
      2 - 0 to 1000 PPM
      Detector S/N 5159A
      10" Sample and Reference Cells

B. Beckman Model 315-A NDIR CO Analyzer.
In two versions as follows:

  (1) Range O-12.5%
      Detector S/N 1329A
      3/4'' Sample Cell
      2-1/2'' Reference Cell
      1-1/2'' Filter Cell

  (2) Range O-12.5%
      Detector S/N 1329A
      1/8'' Sample Cell
      2-1/2'' Reference Cell
      2-1/8'' Filter Cell

C. Mechanical Refrigeration Unit (Built in)

D. Twin Air Controls Inc. "Dia-Pump" Pumps

E. Triple Flip-Top SS 70 MM Filters

F. Double Drierite Dessicant Columns (For NO only)

G. Necessary Flowmeters, Valves, Solenoids, Switches, etc.

H. Heated and Insulated SS and Teflon Sample Line

I. SS Probe

J. Honeywell Electronic 194 Dual Pen Strip Chart Recorder, 10'' Chart

2. Beckman Model 402 Heated F.I.D., Mounted in Special Console.
Heated Sample Line.
Honeywell Electronic 194 Dual Pen Strip Chart Recorder,
10'' Chart.

6.4 Emissions Equipment Gases:

1. FID Burner
   40% Hydrogen, 60% Helium Fuel Gas
   Water Pumped (Breathing) Air

2. FID Zero and Calibration
   Nitrogen Zero Gas
   36 PPM n-Hexane in N_2; Certified ±2%
   106 PPM n-Hexane in N_2; Certified ±2%
   208 PPM n-Hexane in N_2; Certified ±2%
   960 PPM n-Hexane in N_2; Certified ±2%

3. NO Zero and Calibration
   99.997% Purity Nitrogen
   1900 PPM NO in N_2; Certified ±2%
   520 PPM NO in N_2; Certified ±2%

4. CO Zero and Calibration
   99.997% Purity Nitrogen
   .45% CO in N_2; Certified ±2%
   1.05% CO in N_2; Certified ±2%
   5.2% CO in N_2; Certified ±2%
   9.75% CO in N_2; Certified ±2%

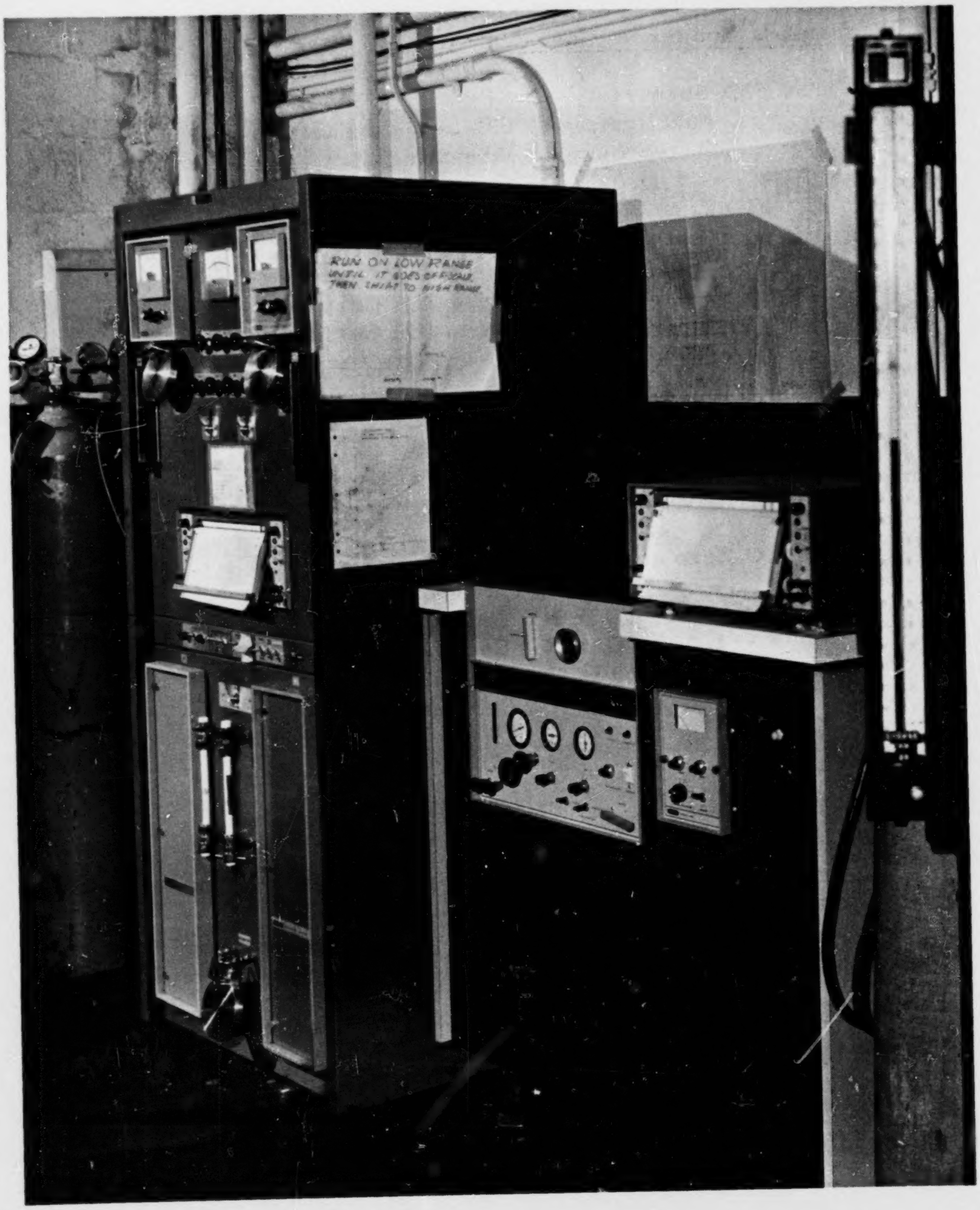

RUN ON LOW RANGE
UNTIL IT GOES OFF SCALE
THEN SHIFT TO HIGH RANGE

Figure 6.1 Scott Console With Beckman NO and CO IR 315 Analyzer and Console with Beckman Model 402 heated F.I.D.

SECTION 7 - PROCEDURE

7.1 Test Numbering System:

The test numbering system consists of three figures:

A. The first figure is a sequential number, indicating the actual test number.

B. The second figure indicates the engine number of each particular model designation.

C. The third figure indicates the test number on the engine in question.

Thus:

36-3-5 indicates

Test #36, third engine of model in question, fifth test on this engine.

7.2 Engine Testing:

A basic 13 mode operational cycle was adopted for all the engines, with different speeds and certain allowances for each model as outlined in Table 7.1.

Table 7.1

Aircraft Engine Test Cycle

Mode	Description	Basic Setting	Engine Speed (RPM)			
			O-200-A	O-470-R	IO-520-D	GTSIO-520-H
1	Cold Start		500	600	600	1500
2	Idle-Taxi-Low	Low Idle, Full Rich	800	700	700	1050
3	Idle-Taxi-High	High Idle, Full Rich	1200	1000	1000	1500
4	Run-Up	Pre-Flight, Mag Check Full Rich	1700	1700	1700	2250
5	Acceleration	Full Throttle, Full Rich				
6	Take-Off	100% Power, Full Rich	2750	2600	2850	3400
7	Take-Off To Climb	Full Rich				
8	Climb	75% Power, Full Rich	(B)	2450	2550	2925
9	Climb	75% Power, Lean (A)	(C)	2450	2550	2925
10	Pattern	40% Power, Full Rich	1950	2000	2000	2700
11	Idle-Taxi	High Idle, Full Rich	1200	1000	1000	1500
12	Shutdown					
13	Hot Start		500	600	600	1050

Notes:
(A) Fuel Flow as Determined by Manufacturer's Recommendations.
(B) Same as for Mode (6) Take-Off.
(C) Not Considered for this Engine Model.

Engine power:

O-200-A: Determined by characteristics of fixed pitch propeller.

O-470-R, IO-520-D, GTSIO-520-H: Determined by fixed engine characteristics plus combination of throttle, mixture control and propeller pitch setting which would give the desired fuel flow and manifold pressure while holding the engine speed to the values listed.

Modes 5, 7 and 12 were considered transient modes and were originally evaluated for emissions. As soon as such evaluation was conducted (see Section 4, Discussion), they were discontinued. Mode 1 was originally sub-divided into four periods, with readings taken at 10, 70, 130 and 190 seconds after starting. Once the transient start-up effects were studied (Section 4, Discussion), only one reading was taken, at about two minutes after start-up.

The cold start test was always performed after the engine had been down for at least one hour. The hot start test was conducted five minutes after shutdown, to allow for good "soak." Tests 4-1-4 and 41-3-2 were conducted with different probe locations in the exhaust system (see Paragraph 7. 3, Emissions measurements).

Engine operating parameters (Fuel Flow vs. Power) were set as per Teledyne Continental recommendations in the Owner's Manuals. Special tests 23-2-3, 32-3-2, 35-4-3, 49-4-3, 52-5-2 at "Best Power" settings were conducted in some engines to determine the effects of leaner mixture operation at all points except take-off.

One test was conducted on an O-470-R (S/N 211333, Test 43-5-2) to determine emissions and engine operating characteristics with variable air fuel ratios.

The O-200's and GTSIO-520's were tested in Cell No. 24. Cell No. 23 was used for the O-470's and IO-520's.

All O-200-A engines were tested with the propeller listed as Item 21. All O-470-R, IO-520-D and GTSIO-520-H engines were tested with the propeller listed as Item 22 and the governor listed as Item 23.

Engine speed was determined with Items 1 and 7 (see Section 6, Equipment). Items 2 and 8 were used to measure operating temperatures. Fuel Flows were measured with Items 3 and 9, taking readings on each instrument until it reached maximum capacity; then readings were conducted with the next larger size rotometer.

Items 10 and 11 were used to determine exhaust gas temperatures on the GTSIO-520's. Item 11A was installed to determine turbine inlet temperatures. Tailpipe temperatures were determined using Item 11B.

Oil pressures were measured with Items 4 and 12B.

In the fuel injected engines, the fuel pump pressure was determined with Items 5 and 13. Items 6 and 14 measured the fuel nozzle (header) pressure.

In all O-200's and GTSIO-520's, plus IO-520-D S/N 159987 and O-470-R, S/N 211333, torque measurements were taken using Items 15 and 16. In all other engines, Items 17 and 18 were used for this purpose.

Air flow to all engines was determined using Items 19 and 20.

7.3 Emissions Measurements:

Probe Location

O-200-A: Left bank exhaust, 3 feet downstream from rear cylinder port*.

O-470-R and IO-520-D: Right bank exhaust, 3 feet downstream from rear cylinder port.

GTSIO-520-H: 3 feet downstream of turbocharger outlet**.

* For special test, also on equivalent position, right bank exhaust. (Test 4-1-4)

** For special test, also downstream of turbo waste gate outlet. (Test 41-3-2)

The FID sample line is electrically heated 1/4" teflon tubing. The sample line for the NDIR instruments was made up of 1/4" stainless steel tubing running alongside the FID sample line and wrapped securely to it with asbestos "belting" and black tape, to keep the sample temperature above the condensation point. At the points where this arrangement was by necessity, impractical, the following arrangements were made:

1. The S. S. sample line was well wrapped and insulated between the sample probe and the point where it ran together with the electrically heated FID line. With the high sample temperature at the probe location and high sample flow rate, there was no chance for condensation in this short (14 inch) length of line.

2. From the point where the two sample lines separated to run to their respective instruments, the NDIR line was made up using thick wall 1/4" ID teflon, well wrapped and insulated, and always running "down" to drain any moisture that could condense. This line was disconnected from the equipment between readings so that it "vented" itself continuously with exhaust gases, thus keeping it hot. As an added precaution to minimize "hang ups" from water or soot condensation, the line was backflushed with dry, filtered air before connecting it to the instrument to obtain readings.

The FID sample train was backflushed between readings, from the sample/calibration/backflush valve, using hydrocarbon-free nitrogen zero gas.

Both sample trains inside the NDIR console were backflushed using dry nitrogen, as often as possible between readings. All filter elements (FID and NDIR) were replaced as often as determined necessary, sometimes more than twice during an engine run. Whenever filters were checked or changed, and whenever the system was backflushed, a quick zero and span gas check was performed, with adjustment of the zero and gain pots if needed.

Beckman recommended operating flows and pressures were used for both the FID and NDIR instruments. The temperature of the NDIR refrigeration (moisture condensation) unit was automatically held at 34°F. The FID oven and sample line were automatically held at 385° F.

For CO measurements, two versions of cell length were used:

A. The first version, with 3/4'' sample cell, 1-1/2'' filter cell and 2-1/2'' reference cell, was the standard arrangement for the instrument as originally purchased for a 0-1.5 percent CO range. Recalibration of the instrument for a 0 to 12.5 percent CO range was done by reducing the electrical gain of the amplifier. A new calibration curve was drawn, but this new curve did not allow good resolution in the high range in which these aircraft engines operate (see Figure B-3 in Appendix B). This set-up used up to and including Test 33-4-1.

B. The second version, assembled after finally receiving the necessary parts from Beckman, had a 1/8'' sample cell, 2-1/8'' filter cell and 2-1/2'' reference cell. Once calibrated, this set up offered very good resolution throughout the operating range from 0 to 12.5 percent (see Figure B-4 in Appendix B). This set up was used from Test 34-4-2 to the end.

SECTION 8 - CALCULATIONS

8.1 Pollutant Mass Flow Rate, gm/Hr.

$$= \frac{PM}{EM} \times \frac{CONC\ (PPM)}{10^{\circ}} \times (F+A) \times 453.6 \times 1-\alpha\frac{F}{A}$$

Where:

PM = Pollutant Molecular Weight
NO_2 = 46.008
CO = 28.010
HC_T = 14.67 (Derived from formulas used by State of California for Heavy Duty Gasoline Engine Tests)

EM = Exhaust Molecular Weight
28.96 for A/F Ratios Stoichimetric and from Figure B-5. Appendix "B", for A/F Ratios Stoichiometric.

CONC (PPM) = Observed Pollutant Concentration in PPM for NDIR Measured Pollutants (NO and CO in this case). This is DRY concentration, since water resulting from combustion has been removed by the sample conditioning train. For HC_T measured with FID (No water removal). The concentration is already expressed as WET.

F = Fuel Flow, Lb/Hr.

A = Air Flow, Lb/Hr.

F+A = Exhaust Flow, Lb/Hr., in "Wet" condition (includes water resulting from combustion process)

α = Hydrogen/Carbon Atom Ratio = 2.12 for this case (for representative gasoline with Formula C_8H_{17}).

$(1-\alpha F/A)$ = Dry/Wet Correction Factor. Used to convert "Dry" concentrations (observed with NDIR) to actual "Wet" exhaust conditions. NOT USED for FID measured hydrocarbons.

A nomograph for quick Mass Flow Rate Determination is included as Figure B-12, Appendix "B". Note that all the water removal correction factors must be applied to the answers if dry (observed) concentrations are used.

Note: A WRH (Relative Humidity Correction Factor), to account for ambient moisture entering engine with air and removed by NDIR sample conditioning train, is included herewith but not used in above formula. WRH is expressed as % water vapor in exhaust. Calculations follow:

$$WRH = \frac{H \times 29.921 \times 519 \times A \times 100}{Baro \times (460 + TA)\ (A + F)}$$

Where:

H = Standard Humidity Ratio, Lb. Moisture/Lb. Dry Air, From ASHRAE Psychrometric Chart No. 1- Sea Level, Standard Temperature.

A = Air Flow, Lb/Hr.

F = Fuel Flow, Lb/Hr.

Baro = Observed (uncorrected) Barometric Pressure "Hg".

TA = Ambient Temperature °F.

Expressed as % water vapor in exhaust, the correction factor can be directly used in the Pollutant Mass Flow Rate Equation; in which case, the Factor $(1-\alpha F/A)$ becomes $(1-\alpha F/A-WRH)$.

In this report, the Factor WRH is included as additional information in the Data and Results Sheet for each test. Correctly applied to any one specific mass calculation, the factor listed must be multiplied by the Air/Exhaust Flow rates. With these engines, this ratio is about .9 (Average A/F Ratio = 10:1). A 90% correction to a 1% factor becomes nil and has not been considered.

8.2 Sample Calculation

Taken at random, from Test 15-3-1, IO-520-D, S/N 159982, at Take-Off.

Concentrations:

NO = 310 ppm
CO = 6.65% or 66500 ppm
HC = 2000 ppm-C

Air Flow = 1534.5 Lb/Hr.

Fuel Flow = 144 Lb/Hr.

Observed BHP = 259.8

A + F = 1678.5 Lb/Hr.

A/F = 10.66

$1-\alpha\frac{F}{A} = .801$

NO_2, gm/Hr.

$$\frac{46.008}{26.74*} \times \frac{310}{10^6} \times 1678.5 \times 453.6 \times .801 = 325$$

NO_2, gm/# Fuel

$$\frac{325}{144} = 2.26$$

NO_2, gm/BHP-Hr.

$$\frac{325}{259.8} = 1.25$$

HC_T, gm/Hr.

$$\frac{14.67}{26.74*} \times \frac{2000}{10^6} \times 1678.5 \times 453.6 = 835.4$$

CO, gm/Hr.

$$\frac{28.01}{26.74*} \times \frac{66500}{10^6} \times 1678.5 \times 453.6 \times .801 = 22482$$

(* 26.74 From Figure B-5 in Appendix "B" for A/F = 10.66)

Relative Humidity Correction Factor (WRH):

Humidity Ratio = .0123 Lb. Moisture/Lb. Dry Air

Ambient Temp. = 79°F.

Observed Baro = 29.16 in. Hg

$$WRH = \frac{.0123 \times 29.921 \times 519 \times 1534.5 \times 100}{29.16 \times (460 + 79) \times 1678.5} = 1.11\%$$

To correct Mass Emissions (NO_2 and CO Only) for Ambient Moisture removed by NDIR sample train, multiply by (1-.011).

Example for NO_2, gm/Hr., with WRH Factor included =

325 x (1-.011) = 321

8.3 Weighed Mass Emissions

The weight factors (WF) correspond to the time percentage in each mode on a cycle.

To obtain weighed mass emissions: The Average mass emission for all engines of the same model, on each cycle, is multiplied by the appropriate weight factor.

In The Summaries:

gm of Pollutant/Minute is obtained by dividing the sum total of the weighed emissions over the cycle by 60.

gm of Pollutant/Cycle = gm/Minute x Minutes/Cycle.

The total gm of Pollutant/Lb., of Fuel over the Cycle is the sum total of the weighed gm of Pollutant per Lb., of Fuel over the Cycle.

Sx = Standard Deviation

$\bar{x}$ = Mean

n = Number of Data Points

$pe_{\bar{x}}$ = Probable Error of the Mean

pe_x = Probable Error

$S_{\bar{x}}$ = Standard Deviation from Mean

Methods presented in "Treatment of Experimental Data," Worthing and Geffy, Wiley 1943, were used in the Statistical Calculations.

SECTION 9 - RESULTS AND RESUMÉ

9.1 Tables 9.1 to 9.8 show the summarized results of the O-200-A engine tests for each mode tested with this engine model.

9.2 Tables 9.9 to 9.18 show the summarized results of the O-470-R engine tests for each of the ten modes tested with this model.

9.3 Tables 9.19 to 9.28 show the summarized results of the IO-520-D engine tests for each of the ten modes tested with this model.

9.4 Tables 9.29 to 9.38 show the summarized results of the GTSIO-520-H engine tests for each of the ten modes tested with this model.

9.5 Table 9.39 shows the true average mass emission level (gm/Hr) and the weighted average mass emission level (gm/Hr x WF) for each mode for each engine model. The relative contribution (%) of each mode over the total cycle is also shown.

9.6 Table 9.40 shows the true average and weighted specific (gm/# Fuel and gm/# Fuel x WF) mass emission level for each mode for each engine model. The relative contribution (%) of each mode over the total cycle is also shown.

9.7 The basic data for each engine test (BHP, Air Flow, Fuel Flow and NO; HC_T-As ppm C-and CO-%-) as well as the computerized results (A + F; A/F Ratio; 1-αF/A; and mass emission values in gm/Hr., gm/# Fuel and gm/BHP-Hr., for each of the three pollutants) is shown in Appendix A.

9.8 Test 4-1-4 shows emissions data and results with samples taken from the left and right exhaust pipes.

9.9 Tests 5-1-5 to 12-2-2 (inclusive) show transient start-up effects on emissions.

9.10 Test 41-3-2 on a GTSIO-520-H shows emissions with sample taken downstream of the turbocharger waste gate.

9.11 Figure 9.1 shows the effects of variable Air/Fuel ratio on emissions and engine performance at 100 percent power with an O-470-R engine.

TABLE 9.1

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

_____OF_____FOR THIS MODE

MODE: COLD START (+130 SEC)

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	500		6.75	.72	.18		—	—		644	161	
213457	6-1-6	470		6.75	.45	.11		—	—		590	147	
213504	7-2-1	500		7.71	.46	.13		202	57		556	159	
213504	8-2-2	505		7.71	.46	.13		—	—		913	260	
213483	13-3-1	502		6.43	.62	.18		141	40		180	75	
213500	14-4-1	500		6.43	.82	.23		230	66		316	90	
213500	18-4-2	510		9.00	1.07	.31		225	64		1128	322	
213500	19-4-3	545		7.71	.92	.26		315	90		846	241	
213474	20-5-1	504		7.71	.73	.21		222	63		846	241	
Sx					.219			56.0			299.2		
$\bar{x}$		504		7.35	.694	.193		222.5	63.3		668.8	188.4	
n					9			6			9		
pe$\bar{x}$					.049			15.4			67.3		
pex					.148			37.8			201.8		
s$\bar{x}$					.073			22.9			99.7		

TABLE 9.2

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

_____OF_____FOR THIS MODE

MODE: IDLE - TAXI - LOW

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	800	2.6	8.33	.77	.14		—	—		1185	214	
213457	6-1-6	800	2.1	8.49	.31	.06		—	—		1009	190	
213504	7-2-1	806	2.8	8.80	.28	.06		321	69		1078	234	
213504	8-2-2	795	2.0	8.37	.25	.06		—	—		1100	250	
213483	13-3-1	802	2.7	11.25	1.20	.32		48	12		1136	284	
213500	14-4-1	802	2.1	11.25	1.83	.46		42	11		1920	298	
213500	18-4-2	810	2.0	10.00	1.38	.31		63	14		1461	324	
213500	19-4-3	803	2.1	10.13	1.16	.29		56	14		1247	311	
213474	20-5-1	807	2.6	10.95	.97	.26		82	22		957	258	
Sx					.551			108.2			296.6		
$\bar{x}$		803	2.3	9.73	.906	.22		102.0	23.7		232.6	262.6	
n					9			6			9		
pe$\bar{x}$					.124			29.8			66.7		
pex					.372			73.0			200.1		
s$\bar{x}$					.184			44.2			98.9		

TABLE 9.3

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF_____FOR THIS MODE

MODE: IDLE-TAXI-HIGH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	1210	6.5	8.78	1.48	.18		——	——		2067	252	318
213457	6-1-6	1200	7.0	11.43	.49	.08		——	——		1906	302	272
213504	7-2-1	1203	8.0	9.33	1.8	.22		379	46		2327	283	
213504	8-2-2	1197	6.8	8.88	1.1	.15		——	——		1489	195	
213483	13-3-1	1195	7.5	10.80	3.8	.52		68	9		1984	264	
213500	14-4-1	1200	6.6	7.71	2.5	.24		169	16		3241	308	
213500	18-4-2	1207	7.0	9.50	2.9	.33		205	23		3295	366	
213500	19-4-3	1203	6.6	8.50	2.2	.24		200	22		3099	344	
213474	20-5-1	1201	7.5	9.00	3.0	.34		97	10		2496	277	
Sx					1,034			109.5			648		
$\bar{x}$		1202	7.1	9.33	2,141	.26		186.3		21.0	2434	287.9	
n					9			6			9		
pe$\bar{x}$					.233			30.1			145.7		
pex					.698			73.9			437.1		
S$\bar{x}$					.345			44.7			216.0		

TABLE 9.4

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF ________FOR THIS MODE

MODE: RUN-UP

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	1700	20.4	11.09	3.6	.26		——	——		4693	340	
213457	6-1-6	1700	20.1	10.80	2.2	.15		——	——		5246	349	
213504	7-2-1	1696	20.3	10.16	3.7	.24		174	11		5704	368	
213504	8-2-2	1702	19.6	11.59	13	1.0		——	——		379	28	
213483	13-3-1	1703	20.9	15.57	51	4.0		22	1.7		347	27	
213500	14-4-1	1703	18.6	9.75	8.9	.57		66	4.2		3888	247	
213500	18-4-2	1685	19.1	9.97	7.4	.44		101	6.1		4438	265	
213500	19-4-3	1705	19.6	10.83	5.4	.41		82	6.1		3826	287	
213474	20-5-1	1704	19.5	11.59	33	2.5		36	2.7		5690	431	
Sx					16.69			54.36			2065		
$\bar{x}$		1700	19.8	11.04	14.24	1.06		80.17	5.3		3801	260.2	
n					9			6			9		
pc$\bar{x}$					3.75			15.0			464.4		
pex					11.26			36.7			1393		
S$\bar{x}$					5.56			22.2			688.5		

TABLE 9.5

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF____FOR THIS MODE

MODE: TAKE-OFF AND CLIMB-RICH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	2810	89.4	10.53	22	.42	.25	—	—	—	23660	440	260
213457	6-1-6	2810	89.6	10.73	38	.73	.43	—	—	—	22019	423	245
213504	7-2-1	2830	91.3	10.87	45	.85	.50	—	—	—	22235	419	243
213504	8-2-2	2840	91.1	10.78	35	.66	.39	—	—	—	15188	286	166
213483	13-3-1	2850	93.3	11.08	88	1.60	.95	194	3.7	2.0	21015	404	225
213500	14-4-1	2820	89.1	10.92	67	1.3	.75	320	6.2	3.5	19140	371	214
213500	18-4-2	2870	88.6	11.06	59	1.13	.67	407	7.7	4.5	20701	394	233
213500	19-4-3	2815	89.0	10.76	71	1.36	.80	428	8.1	4.8	20091	384	225
213474	20-5-1	2820	91.0	10.71	53	1.0	.59	153	2.9	1.6	21614	411	237
Sx					20.48			123.6			2422		
$\bar{x}$		2829	90.3	10.83	53.11	1.01	.59	300.4	5.7	3.6	20629	392	228
n					9			5			9		
pe$\bar{x}$					4.60			37.3			545		
pex					13.8			83.3			1634		
S$\bar{x}$					6.83			55.3			807		

TABLE 9.6

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF ____FOR THIS MODE

MODE: PATTERN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	1950	30.0	9.39	3.7	.16	.12	—	—	—	4860	211	162
213457	6-1-6	1950	28.0	9.00	3.5	.15	.13	—	—	—	4569	198	163
213504	7-2-1	1945	29.3	9.41	3.5	.16	.12	—	—	—	5952	270	203
213504	8-2-2	1952	28.8	9.20	2.7	.13	.09	—	—	—	7171	325	249
213483	13-3-1	—	29.0	9.63	5.6	.26	.19	87	4.0	4.58	4570	210	158
213500	14-4-1	1933	28.3	9.63	9.9	.46	.35	52	2.4	1.84	4485	208	158
213500	18-4-2	1945	28.7	9.60	8.1	.36	.28	127	5.6	4.42	4680	208	163
213500	19-4-3	1944	28.5	9.40	7.2	.32	.25	119	5.3	4.18	4583	203	161
213474	20-5-1	1950	29.1	9.42	7.6	.36	.26	85	3.9	2.92	4388	204	151
Sx					2.55			30.0			930		
$\bar{x}$		1946	28.9	9.41	5.76	.26	.20	94.0	4.2	3.59	5029	226	174
n					9			5			9		
pe$\bar{x}$					.57			9.1			209		
pex					1.72			20.3			627		
S$\bar{x}$					.85			13.4			310		

TABLE 9.7

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF______FOR THIS MODE

MODE: IDLE - TAXI

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	1200	7.2	8.00	1.2	.14		——	——		2890	321	
213457	6-1-6	1200	9.3	6.30	1.0	.10		——	——		1734	173	
213504	7-2-1	1196	7.4	9.00	1.1	.15		——	——		1518	202	
213504	8-2-2	1200	7.0	10.38	1.3	.21		——	——		1375	211	
213483	13-3-1	——	7.1	10.00	2.8	.45		52	8.3		1600	254	
213500	14-4-1	1197	6.6	5.72	1.5	.13		16	1.3		2938	249	
213500	18-4-2	1204	7.0	6.75	1.9	.19		188	18.8		2923	292	
213500	19-4-3	1204	6.6	6.85	1.7	.16		211	20		2981	283	
213474	20-5-1	1197	7.5	6.55	2.4	.24		84	8.2		2010	195	
Sx					.62			85.4			710		
$\bar{x}$		1200	7.3	7.73	1.66	.19		110.2	11.3		2229	242	
n					9			5			9		
$pe_{\bar{x}}$					.14			25.8			160		
pe_x					.42			57.6			479		
$s_{\bar{x}}$					.21			38.2			237		

TABLE 9.8

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF______FOR THIS MODE

MODE: HOT START

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
213457	5-1-5	500		6.75	.63	.16		——	——		1060	265	
213457	6-1-6	—		4.50	.41	.10		——	——		339	84	
213504	7-2-1	510		6.43	.59	.17		——	——		487	139	
213504	8-2-2	510		6.43	.59	.17		——	——		703	201	
213483	13-3-1	506		6.43	.62	.18		177	50		667	190	
213500	14-4-1	622		7.71	1.09	.31		283	81		601	171	
213500	18-4-2	610		7.71	1.00	.29		282	80		579	165	
213500	19-4-3	614		7.50	.82	.23		342	95		599	166	
213474	20-5-1	601		7.71	1.4	.42		323	92		590	168	
Sx					.31			63.8			194		
$\bar{x}$		559		6.79	.79	.22		281	79.6		625	172	
n					9			5			9		
$pe_{\bar{x}}$					.07			19.3			43.7		
pe_x					.21			43.1			131		
$s_{\bar{x}}$					.10			28.6			64.8		

TABLE 9.9

AIRCRAFT EMISSIONS
SUMMARY
O-200-A

____OF____FOR THIS MODE

MODE: COLD START (+130 SEC)

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	620		6.10	6.76	.44		1509	97		2394	154	
211302	22-2-1	601		6.43	7.8	.50		1558	101		3036	197	
211302	23-2-2	603		9.53	3.3	.39		456	53		1755	206	
211302	24-2-3	610		9.23	3.6	.46		481	61		1469	188	
211302	25-2-4	607		8.27	3.3	.33		773	78		2066	210	
211280	31-3-1	610		7.57	3.7	.33		772	68		2393	211	
211280	32-3-2	605		9.47	4.5	.47		762	80		2569	270	
211317	33-4-1	600		7.25	2.7	.23		390	33		2188	185	
211317	34-4-2	602		6.90	3.7	.30		396	32		2953	238	
211317	35-4-3	604		7.58	2.9	.30		433	45		1986	209	
211333	42-5-1	603		7.99	5.2	.49		1201	113		2850	268	
Sx					1.64			439			500		
$\bar{x}$		606.5		7.91	4.32	.38		793.7	69.2		2333	212.4	
n					11			11			11		
$pe_{\bar{x}}$					.33			89.3			102		
pe_x					1.1			296.1			337		
$s_{\bar{x}}$					.49			132.3			151		

TABLE 9.10

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

____OF____FOR THIS MODE

MODE: IDLE-TAXI-LOW

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	810	2.0	7.00	10.5	.59		1937	107		3541	196	
211302	22-2-1	706	1.5	7.00	8.6	.51		1798	107		3718	222	
211302	23-2-2	703	1.6	9.20	2.4	.28		461	52		1754	199	
211302	24-2-3	708	1.9	9.76	3.8	.46		453	54		1721	207	
211302	25-2-4	710	1.9	8.83	3.5	.33		817	76		2792	261	
211280	31-3-1	707	2.3	8.63	4.2	.35		901	75		3572	297	
211280	32-3-2	708	1.6	8.22	4.1	.36		695	60		2822	245	
211317	33-4-1	701	—	8.63	3.4	.28		525	44		2926	243	
211317	34-4-2	701	2.1	7.80	4.2	.33		295	23		3597	283	
211317	35-4-3	702	2.6	7.71	3.2	.31		266	25		2322	221	
211333	42-5-1	706	2.6	8.59	4.8	.44		960	87		3398	308	
Sx					2.47			564			729		
$\bar{x}$		714.7	2.01	8.36	4.79	.38		828	64.5		2924	243.8	
n					11			11			11		
$pe_{\bar{x}}$					.50			115			148		
pe_x					1.67			380			492		
$s_{\bar{x}}$					.75			170			220		

TABLE 9.11

____OF______FOR THIS MODE

AIRCRAFT EMISSIONS SUMMARY O-470-R

MODE: IDLE-TAXI - HIGH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	1005	4.6	8.22	11.0	.56		2263	114		6551	332	
211302	22-2-1	1003	4.2	8.05	9.2	.48		2172	114		6178	325	
211302	23-2-2	1001	4.0	9.92	3.4	.27		351	27		3096	243	
211302	24-2-3	1014	5.0	9.00	6.4	.49		90	7		3362	258	
211302	25-2-4	998	4.9	8.94	4.3	.31		478	33		4092	290	
211280	31-3-1	1008	6.9	9.44	4.4	.31		305	21		4838	334	
211280	32-3-2	1004	5.7	9.57	4.5	.36		188	14		3240	285	
211317	33-4-1	998	—	9.47	3.9	.26		317	21		4470	294	
211317	34-4-2	1000	7.0	9.66	7.4	.45		222	15		4950	332	
211317	35-4-3	1001	6.6	8.40	4.7	.31		257	17		3872	258	
211333	42-5-1	1001	7.2	9.31	6.1	.43		440	30		5119	353	
Sx					2.41			786			1146		
x̄		1003.3	5.61	8.78	5.94	.38		644	37.5		4524	293.5	
n					11			11			11		
pex̄					.49			160			233		
pex					1.62			530			773		
sx̄					.73			237			346		

TABLE 9.12

____OF____FOR THIS MODE

AIRCRAFT EMISSIONS SUMMARY O-470-R

MODE: RUN-UP

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	1720	22.3	9.28	18.3	.57		379	11.8		10890	340	
211302	22-2-1	1710	23.1	9.14	10.0	.31		430	13		13816	418	
211302	23-2-2	1702	22.0	11.45	15.4	.70		148	6.7		6149	279	
211302	24-2-3	1704	24.0	12.14	85	1.1		136	6.3		8377	389	
211302	25-2-4	1701	24.0	9.45	11.6	.39		264	8.8		9215	307	
211280	31-3-1	1704	33.1	10.41	22	.71		228	7.1		8894	277	
211280	32-3-2	1696	32.0	12.46	33	1.3		151	5.8		9906	381	
211317	33-4-1	1697	—	10.86	24	.78		213	6.7		7382	234	
211317	34-4-2	1703	36.6	10.80	33	1.0		219	6.7		9400	289	
211317	35-4-3	1703	35.5	12.46	33	1.3		134	5.1		4388	168	
211333	42-5-1	1700	35.6	10.13	24	.74		251	7.8		11600	362	
Sx					8.27			97.6			2586		
x̄		1704	28.82	10.29	22.7	.81		232	7.8		9090	313.1	
n					11			11			11		
pex̄					1.68			19.8			526		
pex					5.58			65.8			1744		
sx̄					2.50			29.4			780		

TABLE 9.13

____OF____FOR THIS MODE

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

MODE: TAKE-OFF

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	2620	191.1	11.12	85	.64	.44	1268	9.5	6.6	67223	505	351
211302	22-2-1	2594	185.7	10.18	56	.43	.35	1098	8.4	6.9	67189	516	423
211302	23-2-2	2606	186.3	10.04	53	.41	.29	1124	8.6	6.0	66300	510	355
211302	24-2-3	2607	189.6	10.14	90	.69	.48	913	7.0	4.8	66968	515	353
211302	25-2-4	2600	193.6	10.16	64	.48	.33	965	7.3	4.9	68107	515	351
211280	31-3-1	2603	188.3	10.45	84	.64	.44	932	7.1	4.9	68952	530	366
211280	32-3-2	2605	187.5	10.38	92	.71	.49	1039	7.9	5.5	68513	527	365
211317	33-4-1	2610	—	10.96	108	.87	—	1913	15	—	57510	463	—
211317	34-4-2	2603	199.7	10.73	99	.79	.50	876	7.0	4.3	60715	485	304
211317	35-4-3	2608	201.9	10.73	98	.79	.49	1096	8.7	5.4	60715	485	300
211333	42-5-1	2596	208.6	10.15	83	.62	.40	1233	9.2	5.9	67442	507	323
Sx					18.0			288			3870		
$\bar{x}$		2604.6	193.2	10.46	82.9	.642	.421	1132	8.7	5.52	65421	505.3	349.1
n					11			11			11		
$pe_{\bar{x}}$					3.66			58.6			787		
pe_x					12.1			194			2610		
$s\bar{x}$					5.42			86.9			1167		

TABLE 9.14

____OF____FOR THIS MODE

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

MODE: CLIMB-RICH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	2445	152.7	11.86	247	2.81	1.62	331	3.7	2.1	24542	278	160
211302	22-2-1	2450	155.3	11.25	182	2.0	1.1	407	4.5	2.6	25790	286	166
211302	23-2-2	2448	152.9	11.27	153	1.6	1.0	413	4.5	2.7	27192	298	197
211302	24-2-3	2455	150.0	—	—	—	—	—	—	—	—	—	—
211302	25-2-4	2455	158.0	11.55	226	2.5	1.4	360	4.0	2.2	24492	272	155
211280	31-3-1	2455	155.2	12.81	403	4.7	2.5	421	4.9	2.7	19603	230	126
211280	32-3-2												
211317	33-4-1												
211317	34-4-2												
211317	35-4-3												
211333	42-5-1	2455	165.5	12.12	314	3.5	1.9	448	5.0	2.7	29410	334	177
Sx					91.7			43.0			3295		
$\bar{x}$		2452	133.1	11.81	254	2.85	1.59	397	4.43	2.50	25172	283	160.2
n					6			6			6		
$pe_{\bar{x}}$					25.2			11.8			907		
pe_x					61.8			29.0			2223		
$s\bar{x}$					37.4			17.6			1345		

TABLE 9.15

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

____OF____FOR THIS MODE

MODE: CLIMB-LEAN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	2455	153.8	12.33	299	3.45	1.94	278	3.2	1.8	23224	268	151
211302	22-2-1	2451	156.8	11.97	252	2.9	1.6	354	4.1	2.2	23032	266	146
211302	23-2-2	2451	154.0	12.02	235	2.7	1.5	355	4.1	2.3	22694	262	147
211302	24-2-3												
211302	25-2-4												
211280	31-3-1												
211280	32-3-2	2452	152.7	13.91	887	11	5.8	296	3.8	1.9	32290	419	211
211317	33-4-1	2446	—	12.91	738	9.2	—	264	3.3	—	28519	358	—
211317	34-4-2	2448	161.7	12.58	528	6.3	3.2	270	3.2	1.6	20973	252	129
211317	35-4-3	2455	162.0	13.73	810	10	5.0	266	3.4	1.6	11791	153	72
211333	42-5-1	2453	166.3	12.38	307	3.5	1.8	363	4.1	2.1	31230	361	187
Sx					271			44.6			6574		
$\bar{x}$		2451.4	158.2	12.73	507	6.13	2.98	318	3.65	1.93	24219	292.4	149
n					8			8			8		
$pe_{\bar{x}}$					64.5			10.6			1568		
pe_x					182			30.1			4434		
$s\bar{x}$					95.6			15.8			2324		

TABLE 9.16

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

____OF ____FOR THIS MODE

MODE: PATTERN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	2010	39.0	10.98	30.5	.90	.78	252	7.4	6.4	9528	280	244
211302	22-2-1	2000	52.6	10.79	87	2.0	1.6	209	4.9	3.9	10826	257	205
211302	23-2-2	2002	37.0	10.83	19	.59	.51	179	5.5	4.8	10213	319	276
211302	24-2-3												
211302	25-2-4	2005	38.9	10.91	24	.74	.63	185	5.6	4.7	8067	244	207
211280	31-3-1	1995	54.7	11.48	54	1.3	.99	171	4.2	3.1	8352	208	152
211280	32-3-2	2001	51.8	11.37	45	1.1	.87	173	4.5	3.3	9654	254	186
211317	33-4-1	2004	—	11.88	20	.52	—	159	4.0	—	8409	215	—
211317	34-4-2	2003	58.4	11.25	60	1.5	1.0	193	4.8	3.3	11089	277	189
211317	35-4-3	2004	58.8	11.11	53	1.3	.913	181	4.4	3.0	11192	276	190
211333	42-5-1	1997	57.0	11.61	48	1.2	.841	398	10.4	6.9	14122	371	247
Sx					21.3			71.0			1809		
$\bar{x}$		2002	49.8	11.22	44.1	1.12	.903	210	5.57	4.38	10145	270.1	210.7
n					10			10			10		
$pe_{\bar{x}}$					4.55			15.1			386		
pe_x					14.4			47.9			1220		
$s\bar{x}$					6.7			22.4			972		

TABLE 9.17

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

___OF___FOR THIS MODE

MODE: IDLE - TAXI

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	1020	4.3	7.79	10.8	.61		2082	116		4781	267	
211302	22-2-1	1000	4.0	8.16	5.7	.33		2056	120		4279	250	
211302	23-2-2	1003	4.4	10.45	3.8	.34		176	16		2530	225	
211302	24-2-3												
211302	25-2-4	1002	5.0	7.91	3.2	.21		417	28		3435	232	
211280	31-3-1	996	6.4	9.44	5.5	.38		630	44		4950	346	
211280	32-3-2	1003	5.7	9.57	4.9	.39		222	17		2987	235	
211317	33-4-1	1000		9.13	3.0	.21		215	15		3228	233	
211317	34-4-2	1001	6.5	8.75	5.6	.39		236	16		4142	639	
211317	35-4-3	1003	7.0	9.47	5.1	.39		231	17		4043	303	
211333	42-5-1	1003	7.4	9.53	5.9	.43		368	27		5003	365	
Sx					2.19			753			862		
$\bar{x}$		1003.1	5.63	9.02	5.35	.368		663	41.6		39[illegible]	309.3	
n					10			10			10		
$pe_{\bar{x}}$					.47			160.6			184		
pe_x					1.48			507.9			581		
$s\bar{x}$					.69			238.1			272		

TABLE 9.18

AIRCRAFT EMISSIONS
SUMMARY
O-470-R

___OF___FOR THIS MODE

MODE: HOT-START

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
211305	21-1-1	625		5.59	8.2	.57		1325	91		3093	213	
211302	22-2-1	600		6.68	8.4	.54		1612	104		2467	159	
211302	23-2-2	604		8.47	1.9	.23		609	71		1555	183	
211302	24-2-3	—		—	—	—		—	—		—	—	
211302	25-2-4	604		8.60	3.6	.41		1277	143		1813	2031	
211280	31-3-1	595		8.53	4.7	.49		1061	111		1919	202	
211280	32-3-2	602		9.31	4.7	.54		1000	115		1991	228	
211317	33-4-1	655		7.92	2.7	.26		571	53		2086	193	
211317	34-4-2	600		7.66	4.1	.44		594	63		2137	227	
211317	35-4-3	607		8.47	3.6	.43		556	65		2034	239	
211333	42-5-1	604		8.14	5.9	.64		1128	120		2409	256	
Sx					2.16			375			424		
$\bar{x}$		609.6		7.94	4.78	.455		973	93.6		2150	210.3	
n					10			10			10		
$pe_{\bar{x}}$					.46			80.1			91		
pex					1.46			253			286		
$s\bar{x}$					.68			119			134		

TABLE 9.19

1 OF 1 FOR THIS MODE

AIRCRAFT EMISSIONS
SUMMARY
O-520-D

MODE: COLD START + 130 SEC

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1			7.64	2.5	.24					2470	233	
159850	10-1-2			7.50	3.01	.28					2531	243	
159977	11-2-1			7.04	7.8	.68		1181	102		2873	249	
159977	12-2-2			7.97	15.3	1.50		1134	118		300	31	
159982	15-3-1	603		8.10	5.5	.55		470	47		1745	174	
159982	16-3-2	605		7.78	7.0	.87		658	81		260	32	
159983	17-4-1	610		8.57	5.5	.53		1112	105		2020	192	
159987	44-5-1	602		8.91	4.1	.43		799	83		800	83	
159987	45-5-2	605		9.18	3.1	.31		359	37		1012	103	
159987	46-5-3	605		8.47	4.9	.49		997	99		586	58	
S_x					3.73			317			986		
$\bar{x}$		605		7.79	5.87	.588		839	84		1160	139.8	
n					10			8			10		
$pe_{\bar{x}}$					.796			75.6			210		
pe_x					2.52			214			665		
$s_{\bar{x}}$					1.18			112			312		

TABLE 9.20

1 OF 1 FOR THIS MODE

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

MODE: IDLE - LOW - TAXI

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	710	1.9	7.77	2.0	.18					2082	189	
159850	10-1-2	730	1.9	6.95	2.0	.16					2400	195	
159977	11-2-1	685		6.86	9.5	.81		1252	106		2762	234	
159977	12-2-2	705	2.6	7.71	6.1	.59		1218	116		2826	269	
159982	15-3-1	701	2.3	9.43	10.0	.97		280	26		3713	353	
159982	16-3-2	710	1.8	7.86	11.0	1.1		542	52		1807	175	
159983	17-4-1	703	1.7	9.56	6.6	.59		1111	98		3010	260	
159987	44-5-1	702	1.1	8.84	4.7	.42		998	89		927	83	
159987	45-5-2	704	2.7	9.55	3.9	.39		466	47		1024	103	
159987	46-5-3	701	3.1	9.17	5.7	.53		776	72		680	63	
S_x					3.19			370			1006		
$\bar{x}$		705.1	2.1	8.37	6.15	.574		830	75.8		2123	192.4	
n					10			8			10		
$pe_{\bar{x}}$					.68			88.2			215		
pe_x					2.15			249			679		
$s_{\bar{x}}$					1.01			131			318		

TABLE 9.21

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

1 OF 1 FOR THIS MODE

MODE: IDLE- TAXI-HIGH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	1002	4.6	8.16	2.2	.14					2921	182	
159850	10-1-2	1005	4.8	7.99	3.4	.23					3117	205	
159977	11-2-1	1001	4.6	7.96	17.0	.96		1816	100		3098	171	
159977	12-2-2	1003	6.1	7.85	7.7	.45		1709	99		3291	191	
159982	15-3-1	1004	5.4	9.13	9.8	.69		130	9		4240	296	
159982	16-3-2	1003	4.8	9.07	5.8	.43		260	19		3340	249	
159983	17-4-1	1005	4.8	9.28	10.0	.67		970	60		5012	313	
159987	44-5-1	1001	5.8	8.60	7.6	.50		1042	68		2333	153	
159987	45-5-2	1006	6.8	9.75	5.8	.43		549	41		1631	122	
159987	46-5-3	1007	7.9	9.48	20.2	1.30		915	60		1590	104	
Sx					5.70			614			1059		
$\bar{x}$		1003.7	5.6	8.73	8.95	.58		924	57		3057	198.6	
n					10			8			10		
$pe_{\bar{x}}$					1.22			146			226		
pe_x					3.85			414			714		
$s_{\bar{x}}$					1.80			217			335		

TABLE 9.22

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: RUN-UP

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	1730	24.0	8.50	6.2	.17					6867	190	
159850	10-1-2	1720	24.2	8.39	9.9	.27					6705	181	
159977	11-1-2	1696	23.6	8.08	26	.69		838	21		15136	388	
159977	12-2-2	1705	26.6	8.51	14.6	.40		871	24		15318	414	
159982	15-3-1	1710	25.4	9.29	27	.89		237	8		6480	209	
159982	16-3-2	1715	23.5	9.15	17	.56		262	9		7671	251	
159983	17-4-1	1706	23.7	8.87	26	.76		660	19		9681	280	
159987	44-5-1	1709	33.0	9.00	13.5	.37		612	17		14228	389	
159987	45-5-2	1695	33.2	10.20	31	1.04		212	7		6623	221	
159987	46-5-3	1706	34.8	9.36	22.5	.61		736	20		14078	380	
Sx					8.28			276			3921		
$\bar{x}$		1709.2	27.2	89.4	19.37	.576		554	15.6		10279	290.3	
n					10			8			10		
$pe_{\bar{x}}$					1.77			65.7			836		
pe_x					5.59			186			2645		
$s_{\bar{x}}$					2.62			97.4			1240		

TABLE 9.23

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: TAKE OFF

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	2856	263.7	10.80	491	3.3	1.8				39665	273	150
159850	10-1-2	2855	264.2	11.20	456	3.1	1.7				36530	251	138
159977	11-2-1	2842	261.4	10.37	224	1.4	.86	1055	6.8	4.0	57817	375	221
159977	12-2-2	2800	262.8	10.18	227	1.4	.87	1070	7.0	4.0	56705	373	215
159982	15-3-1	2825	259.8	10.66	325	2.2	1.25	837	5.8	3.2	42401	294	163
159982	16-3-2	2860	263.0	10.70	261	1.7	.99	979	6.7	3.7	46058	315	175
159983	17-4-1	2870	255.7	10.23	168	1.1	.66	1102	7.3	4.3	63228	421	247
159987	44-5-1	2852	268.0	10.37	197	1.3	.73	1055	6.8	3.9	64795	420	241
159987	45-5-2	2846	269.3	10.86	201	1.3	.75	1051	6.7	3.9	67418	435	250
159987	46-5-3	2853	271.9	10.39	189	1.2	.73	1019	6.5	3.7	63663	410	234
Sx					114			82.6			11571		
$\bar{x}$		2850	264.0	10.58	274	1.8	1.03	1021.0	6.70	3.83	52828	356.7	203.4
n					10			8			10		
$pe_{\bar{x}}$					24.4			19.7			2468		
pe_x					77.0			55.7			7804		
$s_{\bar{x}}$					36.1			29.2			3659		

TABLE 9.24

AIRCRAFT EMISSIONS
SUMMARY
IO -520-D

____OF____FOR THIS MODE

MODE: CLIMB-RICH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	2548	202.1	10.80	381	3.4	1.8				30091	273	148
159850	10-1-2	2560	202.3	10.78	335	3.0	1.7				29327	264	145
159977	11-2-1	2556	200.0	9.70	143	1.1	.72	803	6.5	4.0	48198	391	240
159977	12-2-2	2560	206.2	9.80	157	1.2	.76	776	6.3	3.7	46225	375	224
159982	15-3-1	2550	205.9	10.77	345	3.0	1.68	656	5.8	3.1	28548	254	138
159982	16-3-1	2562	207.3	10.93	334	2.9	1.60	663	5.9	3.1	29966	267	144
159983	17-4-1	2551	201.6	10.04	201	1.7	1.00	783	6.6	3.8	37171	317	184
159987	44-5-1	2556	207.1	10.29	151	1.3	.73	709	5.9	3.4	49661	417	239
159987	45-5-2	2554	211.3	10.36	151	1.2	.72	974	7.9	4.6	49975	409	236
159987	46-5-3	2547	212.4	10.43	185	1.3	.75	859	7.1	4.0	49430	411	232
Sx					97.4			106			9658		
$\bar{x}$		2554.4	205.6	10.39	232.3	2.01	1.15	778	6.5	3.71	39859	337.8	193.0
n					10			8			10		
$pe_{\bar{x}}$					20.8			25.3			2060		
pe_x					65.7			71.4			6514		
$s_{\bar{x}}$					30.8			37.4			3054		

TABLE 9.25

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: CLIMB-LEAN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	2555	202.9	12.86							4839	52	23
159850	10-1-2	2560	203.3	12.96							3897	42	19
159977	11-2-1	2555	204.8	12.86	1791	19.0	8.7	396	4.3	1.9	4355	47	21
159977	12-2-2	2555	209.2	12.91	2256	24.5	10.7	366	3.9	1.7	4030	43	19
159982	15-3-1	2551	207.9	12.91	2296	24.9	11.0	489	5.3	2.3	3884	42	18
159982	16-3-2	2559	209.5	13.16	2131	23.0	10.0	464	5.0	2.2	4936	53	23
159983	17-4-1	2555	204.8	12.62	1643	17.0	8.0	481	5.2	2.3	29025	315	141
159987	44-5-1	2547	210.2	13.16	1786	19.4	8.4	433	4.7	2.1	10860	118	51
159987	45-5-2	2551	217.8	13.07	1354	14.2	6.2	668	7.0	3.0	15967	168	73
159987	46-5-3	2546	218.1	13.50	1411	15.3	6.4	630	6.8	2.8	15900	172	72
Sx					364			107			8347		
$\bar{x}$		2553.4	208.9	12.90	1834	19.66	8.67	491	3.01	2.28	9769	105.2	46.0
n					8			8			10		
$pe_{\bar{x}}$					86.9			25.4			1780		
pe_x					246			71.9			5630		
$s_{\bar{x}}$					129			37.7			2639		

TABLE 9.26

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: PATTERN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	1980	35.4	8.40							12716	282	359
159850	10-1-2	2020	35.8	7.69	8.7	.18	.24				9435	196	264
159977	11-2-1	2000	37.3	8.61	14.0	.32	.38	1264	27	34	20000	430	536
159977	12-2-2	2003	40.0	8.51	23.2	.51	.58	1250	27	31	19851	431	496
159982	15-3-1	1904	32.3	8.87	24.0	.70	1.03	317	9	10	10318	299	263
159982	16-3-2	1995	38.0	9.73	28.0	.77	.74	383	10	10	12450	336	328
159983	17-4-1	2000	35.8	9.00	21.0	.49	.59	1054	24	29	18696	434	522
159987	44-5-1	2000	54.3	8.91	22.4	.46	.41	753	15	14	20537	419	378
159987	45-5-2	2003	55.7	9.00	25.4	.52	.46	688	14	13	19997	412	459
159987	46-5-3	2001	56.8	9.18	25.4	.50	.45	859	17	15	21626	428	381
Sx					6.15			359			4737		
$\bar{x}$		1990.6	42.1	8.69	21.3	.49	.54	821	17.9	20	16563	366.7	389
n					9			8			10		
$pe_{\bar{x}}$					1.38			85.7			1010		
pe_x					4.15			242			3195		
$s_{\bar{x}}$					2.05			127			1498		

TABLE 9.27

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: IDLE - TAXI

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	1002	4.6	7.31	2.3	.15					2830	176	
159850	10-1-2	980	4.5	7.76	3.2	.22					2739	188	
159977	11-2-1	1002	4.2	8.01	4.7	.33		1299	89		2615	179	
159977	12-2-2	1001	5.7	8.24	7.9	.56		1719	121		2523	177	
159982	15-3-1	1004	5.0	8.65	6.5	.50		244	18		2480	190	
159982	16-3-2	1007	5.0	9.14	6.0	.47		250	19		2534	198	
159983	17-4-1	1005	4.0	9.47	9.3	.70		1513	113		4620	347	
159987	44-5-1	1002	5.6	8.50	7.9	.55		973	68		2171	151	
159987	45-5-2	1003	6.6	9.00	7.4	.55		1480	109		1846	136	
159987	46-5-3	998	7.0	9.13	8.6	.63		1259	91		1890	137	
S_x					2.33			565			777		
$\bar{x}$		1000.2	5.2	8.37	6.38	.466		1092	78.5		2625	187.9	
n					10			8			10		
$pe_{\bar{x}}$					.50			135			166		
pe_x					1.57			381			524		
$s_{\bar{x}}$					.74			200			246		

TABLE 9.28

AIRCRAFT EMISSIONS
SUMMARY
IO-520-D

____OF____FOR THIS MODE

MODE: HOT - START

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
159850	9-1-1	675		7.71	1.3	.13					2706	257	
159850	10-1-2	680		7.71	3.0	.29					2606	248	
159977	11-2-1	591		8.33	2.7	.34		890	109		2045	252	
159977	12-2-2	609		6.75	4.9	.49		1048	104		2022	202	
159982	15-3-1	610		7.59	3.8	.46		710	85		1725	207	
159982	16-3-2	608		8.66	3.5	.47		706	94		1784	237	
159983	17-4-1	607		7.24	4.9	.57		959	110		2320	260	
159987	44-5-1	604		6.88	4.3	.51		907	106		418	49	
159987	45-5-2	603		8.65	4.1	.53		978	125		575	74	
159987	46-5-3	605		8.74	4.5	.54		1074	126		494	58	
S_x					1.12			139			869		
$\bar{x}$		619.2		7.68	3.70	.433		909	107.4		1670	184.4	
n					10			8			10		
$pe_{\bar{x}}$					.24			33.1			185		
pe_x					.76			93.7			586		
$s_{\bar{x}}$					.36			49.1			275		

TABLE 9.29

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: COLD START (+130 SEC)

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	1505		8.33	8.4	.31		989	36		9710	350	
210206	37-2-1	1503		11.05	9.1	.41		393	17		7658	348	
210206	38-2-2	1506		11.35	19	.85		419	18		7454	324	
210206	39-2-3	1503		11.20	13	.57		338	15		7412	329	
210219	40-3-1	1505		10.26	13	.53		247	10		8806	352	
210219	41-3-2	1504		10.13	10	.43		336	14		8346	347	
210221	47-4-1	1506		10.26	11	.44		354	14		10407	416	
210221	48-4-2	1507		9.88	9	.37		400	16		10130	397	
210221	49-4-3	1500		11.45	14	.62		222	10		8599	390	
210221	50-4-4	1500		10.69	24	.98		222	9		10128	422	
210212	51-5-1	1508		10.44	11	.43		243	10		9769	390	
210212	52-5-2	1504		11.78	14	.72		143	7		5524	289	
210212	53-5-3	1504		9.92	10	.42		508	21		9768	399	
Sx					4.44			211			1438		
$\bar{x}$		1504		10.52	12.73	.54		370	15.2		8747	365.6	
n					13			13			13		
$pe_{\bar{x}}$					.83			39.5			269		
pe_x					2.99			142			970		
$s_{\bar{x}}$					1.23			58.6			399		

TABLE 9.30

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: IDLE-TAXI-LOW

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	1050		10.00	.92	.07		469	34		4216	312	
210206	37-2-1	1053	5.9	12.00	3.4	.28		606	50		2669	222	
210206	38-2-2	1055	6.2	12.74	8	.64		385	32		2013	172	
210206	39-2-3	1055	5.8	11.71	4.9	.40		477	38		2526	205	
210219	40-3-1	1055	7.0	11.04	7	.49		362	27		2039	151	
210219	41-3-2	1052	5.7	11.68	6	.49		611	46		821	63	
210221	47-4-1	1051	7.6	10.93	6.8	.48		310	22		4317	308	
210221	48-4-2	1053	6.8	11.09	5.3	.38		382	27		4080	287	
210221	49-4-3	1055	6.6	11.50	6.8	.51		306	23		3542	266	
210221	50-4-4	1050	6.1	10.21	4.4	.31		398	28		3746	265	
210212	51-5-1	1055	6.8	10.24	5	.35		533	37		4264	294	
210212	52-5-2	1056	6.9	11.16	5.9	.46		232	18		3222	249	
210212	53-5-3	1055	6.9	9.71	6	.40		378	27		3712	267	
Sx					1.82			115			1080		
$\bar{x}$		1053	6.03	11.23	5.42	.40		419	31.5		3167	235.5	
n					13			13			13		
$pe_{\bar{x}}$					.34			21.5			202		
pe_x					1.23			77.4			729		
$s_{\bar{x}}$					.50			31.8			300		

TABLE 9.31

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

___OF___FOR THIS MODE

MODE: IDLE-TAXI-HIGH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2 gm/HR	NO_2 gm/#FUEL	NO_2 gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
188284	36-1-1	1498		10.23	6.9	.32		1398	63		9598	436	
210206	37-2-1	1501	16.9	11.05	6.6	.30		393	17		7356	334	
210206	38-2-2	1506	19.0	11.35	11	.50		349	15		7616	331	
210206	39-2-2	1500	17.4	11.60	12	.51		416	18		7495	333	
210219	40-3-1	1504	19.3	10.40	12	.53		257	11		8120	360	
210219	41-3-2	1510	19.2	10.84	12	.56		226	10		7970	362	
210221	47-4-1	1502	19.4	10.40	11	.46		225	10		3212	142	
210221	48-4-2	1505	18.5	10.44	10	.43		250	10		3582	143	
210221	49-4-3	1501	19.1	11.36	14	.66		191	9		7601	361	
210221	50-4-4	1502	18.5	10.64	8	.36		236	11		7925	360	
210212	51-5-1	1506	17.9	10.12	8.3	.35		336	14		9307	387	
210212	52-5-2	1498	17.2	11.66	11	.60		194	8		6226	322	
210212	53-5-3	1501	17.1	10.57	8.3	.36		213	9		11212	487	
Sx					2.27			321			2191		
$\bar{x}$		1502	18.3	10.82	10.09	.45		360	15.8		7478	335.2	
n					13			13			13		
$pe_{\bar{x}}$					.43			60.0			410		
pe_x					1.53			216			1478		
$s\bar{x}$					.63			88.9			608		

TABLE 9.32

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H'

___OF___FOR THIS MODE

MODE: RUN-UP

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2 gm/HR	NO_2 gm/#FUEL	NO_2 gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
188284	36-1-1	2255	22.3	8.85	16	.27		3008	51		27162	460	
210206	37-2-1	2245	57.8	10.00	23	.42		451	8		23389	433	
210206	38-2-2	2245	59.4	12.58	93	2.1		258	6		12367	281	
210206	39-2-3	2249	57.5	10.16	35	.64		398	7		23157	424	
210219	40-3-1	2245	60.7	9.20	32	.54		461	8		24862	424	
210219	41-3-2	2250	62.4	12.60	88	2		264	6		12899	286	
210221	47-4-1	2251	63.4	10.30	38	.70		425	8		24137	434	
210221	48-4-2	2252	60.6	9.97	37	.68		400	7.2		23398	421	
210221	49-4-3	2255	59.8	11.60	59	1.3		250	5.5		14991	333	
210221	50-4-4	2252	62.3	9.88	34	.61		401	7.2		73629	421	
210212	51-5-1	2243	58.1	9.96	25	.44		485	8.5		24600	435	
210212	52-5-2	2244	58.7	10.91	42	.86		292	6		18712	378	
210212	53-5-3	2247	57.5	9.95	25	.44		505	8.9		26215	460	
Sx					23.9			734			5034		
$\bar{x}$		2249	57.0	10.46	42.1	.85		584	10.6		21501	399.2	
n					13			13			13		
$pe_{\bar{x}}$					4.48			137			942		
pe_x					16.2			495			3396		
$s\bar{x}$					6.34			203			1396		

TABLE 9.33

AIRCRAFT EMISSIONS SUMMARY GTSIO-520-H

___OF___FOR THIS MODE

MODE: TAKE-OFF

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	3410	361.0	9.38	124	.48	.34	1234	4.7	3.4	126109	488	349
210206	37-2-1	3395	360.7	9.36	70	.27	.195	1385	5.3	3.8	127300	480	350
210206	38-2-2	3402	362.7	9.[illegible]	141	.55	.39	1026	4.0	2.8	122076	476	336
210206	39-2-3	3408	350.2	9.48	110	.42	.314	1258	4.8	3.5	128873	493	367
210219	40-3-1	3410	359.7	9.31	108	.41	.30	1242	4.7	3.4	126572	484	351
210219	41-3-2	3403	359.4	9.42	124	.48	.34	1023	3.9	2.8	125642	490	349
210221	47-4-1	3402	364.5	9.50	123	.52	.36	1229	4.8	3.3	85756	337	235
210221	48-4-2	3402	366.2	9.74	127	.50	.35	1248	4.9	3.4	125810	495	343
210221	49-4-3	3410	362.7	9.53	163	.64	.45	1092	4.3	3.0	123085	484	339
210221	50-4-4	3395	359.0	10.08	150	.62	.42	1146	4.7	3.2	121418	503	338
210212	51-5-1	3399	351.9	9.43	92	.36	.26	1244	4.8	3.5	125247	483	355
210212	52-5-2	3407	347.1	9.46	103	.40	.29	1163	4.5	3.3	126110	490	360
210212	53-5-3	3404	350.2	9.32				1189	4.6	3.4			
Sx					25.4			101			11613		
$\bar{x}$		3404	358.1	9.50	120	.47	.33	1191	4.61	3.29	122000	475.3	339.3
n					12			13			12		
pe$\bar{x}$					4.95			18.9			2261		
pe$_x$					17.1			68.0			7833		
s$\bar{x}$					7.33			28.0			3352		

TABLE 9.34

AIRCRAFT EMISSIONS SUMMARY GTSIO-520-H

___OF___FOR THIS MODE

MODE: CLIMB-RICH

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO$_2$			HC$_T$			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	2990	257.5	10.40	160	1.00	.62	598	3.7	2.3	74855	465	291
210206	37-2-1	2922	271.9	10.88	196	1.3	.72	459	3.0	1.6	67545	450	248
210206	38-2-2	2927											
210206	39-2-3	2924	264.1	10.81	205	1.3	.78	514	3.2	1.9	64237	404	243
210219	40-3-1	2927	296.6	11.08	277	1.8	.93	512	3.2	1.7	63047	404	212
210219	41-3-2												
210221	47-4-1	2931	262.7	10.21	166	1.0	.63	602	3.6	2.2	68981	420	262
210221	48-4-2	2930	265.2	10.57	162	1.0	.62	558	3.4	2.1	70001	434	263
210221	49-4-3	2923	264.2	10.55	202	2.0	.77	554	3.4	3.0	68749	429	260
210221	50-4-4	2925	264.0	10.75	187	2.2	.71	558	3.5	2.1	70310	442	266
210212	51-5-1	2924	264.7	10.74	182	1.1	.69	515	3.2	1.9	66400	415	250
210212	52-5-2	2926	267.2	10.87	200	1.2	.75	469	2.9	1.7	65989	415	246
210212	53-5-3	2926	261.7	10.53				514	3.1	1.9			
Sx					33.8			46.6			3389		
$\bar{x}$		2931.3	267.3	10.67	194	1.39	.72	532	3.29	2.03	68011	427.8	254.1
n					10			11			10		
pe$\bar{x}$					7.21			9.5			723		
pex					22.8			31.4			2286		
s$\bar{x}$					10.7			14.1			1072		

TABLE 9.35

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: CLIMB-LEAN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	3000	262.4	12.67	997	7.4	3.8	394	2.9	1.5	36389	272	138
210206	37-2-1	2920	281.3	12.74	1202	9.0	4.2	307	2.3	1.0	29596	221	105
210206	38-2-2	2912	271.1	12.81	897	6.7	3.3	264	1.9	1.0	35331	264	130
210206	39-2-3	2926	270.2	12.81	1288	9.6	4.7	308	2.3	1.1	27635	207	102
210219	40-3-1	2930	274.3	12.74	1157	8.7	4.2	351	2.6	1.2	31337	234	114
210219	41-3-2	2920	270.6	12.71	1057	7.9	3.9	307	2.3	1.2	31619	236	116
210221	47-4-1	2932	276.5	12.74	687	5.1	2.9	351	2.6	1.2	23328	174	843
210221	48-4-2	2930	275.2	12.69	1059	7.9	3.8	764	1.9	1.0	31350	233	113
210221	49-4-3	2924	270.9	12.54	1044	7.9	3.9	304	2.2	1.1	31239	234	115
210221	50-4-4	2924	267.6	12.67	855	7.0	3.2	306	2.2	1.1	36042	269	134
210212	51-5-1	2927	269.8	12.74	939	7.0	3.5	351	2.6	1.3	31685	237	117
210212	52-5-2	2928	270.8	12.81	1035	8.0	3.9	264	1.9	1.0	31483	235	116
210212	53-5-3	2923	266.6	12.71				263	1.9	1.0			
S_x					162			131			3626		
$\bar{x}$		2930	271.3	12.72	1018	7.68	3.77	349	2.27	1.13	31420	234.7	115.4
n					12			13			12		
$pe_{\bar{x}}$					31.5			24.5			706		
pe_x					109			88.2			2446		
$s_{\bar{x}}$					46.7			36.3			1047		

TABLE 9.36

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: PATTERN

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	2860	177.2	11.02	186	1.7	1.05	373	3.5	2.10	11466	109	65
210206	37-2-1	2695	177.5	10.58	121	1.1	.68	376	3.4	2.11	43423	400	245
210206	38-2-2	2696	179.5	12.26	451	4.8	2.51	271	2.8	1.51	25812	274	144
210206	39-2-3	2695	172.9	10.68	129	1.2	.75	407	3.7	2.35	43880	408	254
210219	40-3-1	2690	170.0	10.62	138	1.3	.81	409	3.7	2.41	44525	410	262
210219	41-3-2	2703	178.4	12.80	732	8.1	4.10	267	2.9	1.53	20033	222	112
210221	47-4-1	2702	173.9	10.48	129	1.2	.74	440	4.0	2.53	43422	396	250
210221	48-4-2	2695	169.7	10.55	122	1.1	.72	372	3.4	2.19	43842	407	258
210221	49-4-3	2701	175.5	12.69	798	9.0	4.55	263	2.9	1.50	17117	192	98
210221	50-4-4	2695	169.7	10.88	137	1.3	.81	404	3.8	2.38	44295	419	261
210212	51-5-1	2692	170.7	10.82	146	1.4	.86	438	4.1	2.51	38025	357	223
210212	52-5-2	2695	171.6	13.08	1079	1.2	6.29	230	2.6	1.34	12166	141	71
210212	53-5-3	2693	167.0	10.47	116	1.1	.69	404	3.7	2.42	42441	391	254
S_x					329			73.2			13533		
$\bar{x}$		2695	173.4	11.30	330	3.5	1.89	358	3.42	2.07	33111	317	192
n					13			13			13		
$pe_{\bar{x}}$					61.5			13.7			2532		
pe_x					222			49.4			9128		
$s_{\bar{x}}$					91.2			20.3			3753		
MEAN VALUES:													
FULL RICH RUNS		2695	171.4	10.64	129	1.21	.76	406	3.73	2.37	42982	399	251
BEST POWER RUNS		2695	176.4	12.37	649	7.12	3.70	281	2.94	1.60	17319	188	98

TABLE 9.37

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: IDLE-TAXI

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	1507	11.5	9.61	9.8	.43		1088	47		976	42	
210206	37-2-1	1505	16.7	9.86	4.2	.20		346	16		6467	207	
210206	38-2-2	1496	17.8	9.86	9.2	.44		520	24		5001	238	
210206	39-2-3	1493	17.9	10.52	9.4	.45		302	14		6983	332	
210219	40-3-1	1490	18.5	9.86	11	.51		266	12		7771	361	
210219	41-3-2	1501	18.4	11.54	13	.68		149	7.6		5900	302	
210221	47-4-1	1500	19.4	9.57	8.0	.33		380	16		9141	389	
210221	48-4-2	1502	18.7	9.00	7.2	.31		333	14		8588	365	
210221	49-4-3	1501	18.1	10.50	11	.54		272	13		7472	355	
210221	50-4-4	1500	18.5	9.70	8.0	.33		473	20		9515	410	
210212	51-5-1	1495	17.5	10.17	6.4	.28		518	23		9059	393	
210212	52-5-2	1493	17.3	10.45	8.0	.39		255	13		7317	369	
210212	53-5-3	1496	16.8	9.56	8.0	.29		582	24		9468	394	
Sx					2.25			236			2344		
$\bar{x}$		1498	17.5	10.02	8.71	.398		422	18.7		7204	327.5	
n					13			13			13		
$pe_{\bar{x}}$					.42			44.2			438		
pe_x					1.52			159			1581		
$s\bar{x}$					.62			65.5			650		

TABLE 9.38

AIRCRAFT EMISSIONS
SUMMARY
GTSIO-520-H

____OF____FOR THIS MODE

MODE: HOT START

ENGINE S/N	TEST NUMBER	RPM	BHP	A/F	NO_2			HC_T			CO		
					g^m/HR	g^m/#FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR	g^m/HR	g^m/# FUEL	g^m/BHP-HR
188284	36-1-1	1050		15.16	.95	.10		439	46		3793	399	
210206	37-2-1	1045		11.52	3.4	.27		480	38		2530	202	
210206	38-2-2	1052		12.20	6.0	.51		471	39		2428	205	
210206	39-2-3	1053		13.30	6.0	.53		379	34		2578	230	
210219	40-3-1	1055		11.25	7.3	.57		386	30		2027	158	
210219	41-3-2	1045		12.21	7.6	.55		487	40		1532	125	
210221	42-4-1	1051		10.29	6.1	.44		417	30		3535	252	
210221	48-4-2	1051		10.70	6.4	.45		417	29		4036	282	
210221	49-4-3	1053		10.91	7.8	.60		487	37		3406	258	
210221	50-4-4	1058		9.60	6.4	.43		567	38		3660	244	
210212	51-5-1	1048		10.38	5.6	.39		694	48		4385	306	
210212	52-5-2	1048		10.31	5.5	.42		465	35		3258	248	
210212	53-5-3	1051		10.76	7.0	.44		565	41		4193	303	
Sx					1.85			86.4			885		
$\bar{x}$					5.85			481			3182		
n					13			13			13		
$pe_{\bar{x}}$					.35			16.2			166		
pe_x					1.25			58.3			597		
$s\bar{x}$					.51			24.0			245		

TABLE 9.39

WEIGHTED MASS EMISSIONS, gm/HR.

MODE	WF %	NO_2			HC_T			CO		
		gm/HR	xWF	%	gm/HR	xWF	%	gm/HR	xWF	%
O-200-A										
1 - COLD START	4.47	.69	.03	.16	223	9.97	5.55	669	29.9	.35
2 - IDLE-TAXI-LOW	8.95	.91	.08	.42	102	9.13	5.09	1233	110.4	1.29
3 - IDLE-TAXI-HIGH	13.42	2.14	.29	1.54	186	24.96	13.90	2434	326.6	3.81
4 - RUN-UP	4.47	14.2	.63	3.34	80	3.58	1.99	3801	169.9	1.98
5 - TAKE-OFF	1.34	53.1	.71	3.77	300	4.02	2.24	20,629	276.4	3.23
6 - CLIMB-RICH	28.65	53.1	15.21	80.73	300	85.95	47.87	20,629	5910.2	68.99
8 - PATTERN	28.65	5.8	1.66	8.81	94	26.93	15.00	5028	1440.5	16.82
9 - IDLE-TAXI	13.64	1.65	.23	1.22	110	15.00	8.35	2219	302.7	3.53
TOTALS			18.84	99.99		179.54	99.99		8566.6	100.00
O-470-R										
1 - COLD START	4.47	4.3	.19	.21	794	35.49	7.34	2332	104.2	.81
2 - IDLE-TAXI-LOW	8.95	4.8	.43	.48	801	71.69	14.83	2924	261.7	2.04
3 - IDLE-TAXI-HIGH	13.42	5.9	.79	.88	644	86.42	17.88	4524	607.1	4.72
4 - RUN-UP	4.47	22.7	1.01	1.13	232	10.37	2.14	9090	406.3	3.16
5 - TAKE-OFF	1.34	82.9	1.11	1.24	1133	15.18	3.14	60,421	823.0	6.40
6 - CLIMB-RICH	28.65	254.0	72.77	81.15	397	113.7	23.52	25,172	7212.0	56.09
8 - PATTERN	28.65	44.1	12.63	14.08	210	60.17	12.45	10,145	2907.0	22.61
9 - IDLE-TAXI	13.64	5.4	.74	.83	663	90.43	18.71	3938	537.1	4.18
TOTALS			89.67	100.00		483.45	100.01		12,858.4	100.01
IO-520-D										
1 - COLD START	8.16	5.9	.48	.18	839	68.46	8.50	1460	119.1	.92
2 - IDLE-TAXI-LOW	8.16	6.2	.51	.19	830	67.73	8.41	2123	174.0	1.34
3 - IDLE-TAXI-HIGH	12.24	9.0	1.10	.41	924	113.10	14.04	3057	374.2	2.89
4 - RUN-UP	8.16	19.4	1.58	.59	554	45.21	5.61	10,279	838.8	6.48
5 - TAKE-OFF	1.72	274.0	4.71	1.76	1021	17.56	2.18	53,828	925.8	7.15
6 - CLIMB-RICH	12.37	238.0	29.44	10.99	778	96.24	11.95	39,859	4931.0	38.10
7 - CLIMB-LEAN	12.24	1834.0	224.5	83.79	491	60.10	7.46	9769	1196.0	9.24
8 - PATTERN	24.49	21.3	5.21	1.94	821	201.1	24.97	16,563	4056.0	31.34
9 - IDLE-TAXI	12.45	6.4	.80	.30	1092	136.0	16.88	2625	326.8	2.53
TOTALS			267.92	100.15		805.50	100.00		12,941.7	99.99
GTSIO-520-H										
1 - COLD START	8.16	12.7	1.04	.44	370	30.19	7.01	8747	713.8	2.64
2 - IDLE-TAXI-LOW	8.16	5.4	.44	.18	419	39.19	9.10	3167	258.4	.96
3 - IDLE-TAXI-HIGH	12.24	10.1	1.24	.52	360	44.06	10.23	7478	915.3	3.39
4 - RUN-UP	8.16	42.1	3.44	1.44	585	47.74	11.09	21,501	1755.0	6.50
5 - TAKE-OFF	1.72	120.0	2.06	.86	1191	20.49	4.76	121,990	2098.0	7.77
6 - CLIMB-RICH	12.37	194.0	24.00	10.05	532	65.81	15.29	68,011	8413.0	31.15
7 - CLIMB-LEAN	12.24	1018.0	124.6	52.20	350	42.84	9.95	31,419	3846.0	14.24
8 - PATTERN	24.49	330.0	80.82	33.86	358	87.67	20.36	33,133	8114.0	30.04
9 - IDLE-TAXI	12.45	8.7	1.08	.45	422	52.54	12.20	7205	897.0	3.32
TOTALS			238.72	100.00		430.53	99.99		27,010.5	100.01

TABLE 9.40

WEIGHTED MASS EMISSIONS, gm/#FUEL

MODE	WF %	NO_2			HC_T			CO		
		gm/#FUEL	xWF	%	gm/#FUEL	xWF	%	gm/#FUEL	xWF	%
0-200-A										
1 - COLD START	4.47	.19	.01	1.96	63.3	2.83	22.73	188	8.40	2.82
2 - IDLE-TAXI-LOW	8.95	.22	.02	3.92	23.7	2.12	17.03	263	23.54	7.91
3 - IDLE-TAXI-HIGH	13.42	.26	.03	5.88	21.0	2.81	22.57	288	38.65	12.99
4 - RUN-UP	4.47	1.06	.05	9.80	5.3	.24	1.93	260	11.62	3.91
5 - TAKE-OFF	1.34	1.01	.01	1.96	5.7	.08	.64	392	5.25	1.76
6 - CLIMB-RICH	28.65	1.01	.29	56.86	5.7	1.63	13.09	392	112.31	37.75
8 - PATTERN	28.65	.26	.07	13.73	4.2	1.20	9.64	226	64.75	21.76
9 - IDLE-TAXI	13.64	.19	.03	5.88	11.3	1.54	12.37	242	33.01	11.09
TOTALS			.51	99.99		12.45	100.00		297.53	99.99
0-470-R										
1 - COLD START	4.47	.38	.02	1.49	62.9	2.81	12.43	212	9.48	3.25
2 - IDLE-TAXI-LOW	8.95	.38	.03	2.24	64.5	5.77	25.52	244	21.84	7.48
3 - IDLE-TAXI-HIGH	13.42	.38	.05	3.73	37.5	5.03	22.25	294	39.45	13.52
4 - RUN-UP	4.47	.81	.04	2.99	7.8	.35	1.55	313	13.99	4.79
5 - TAKE-OFF	1.34	.64	.01	.75	8.7	.12	.53	505	6.77	2.32
6 - CLIMB-RICH	28.65	2.85	.82	61.19	4.4	1.26	5.57	283	80.94	27.73
8 - PATTERN	28.65	1.12	.32	23.88	5.6	1.60	7.08	270	77.22	26.46
9 - IDLE-TAXI	13.64	.37	.05	3.73	41.6	5.67	25.08	309	42.15	14.44
TOTALS			1.34	100.00		22.61	100.01		291.84	99.99
IO-520-D										
1 - COLD START	8.16	.59	.05	1.62	84.0	6.85	18.65	140	11.42	4.58
2 - IDLE-TAXI-LOW	8.16	.57	.05	1.62	75.6	6.17	16.80	192	15.67	6.29
3 - IDLE-TAXI-HIGH	12.24	.58	.07	2.27	57.0	6.98	19.01	199	24.36	9.78
4 - RUN-UP	8.16	.58	.05	1.62	15.6	1.27	3.46	290	23.66	9.49
5 - TAKE-OFF	1.72	1.8	.03	.97	6.7	.12	.33	357	6.14	2.46
6 - CLIMB-RICH	12.37	2.0	.25	8.09	6.5	.80	2.18	338	41.81	16.78
7 - CLIMB-LEAN	12.24	19.7	2.41	77.99	3.0	.37	1.01	105	12.85	5.16
8 - PATTERN	24.49	.49	.12	3.88	17.9	4.39	11.96	367	89.88	36.07
9 - IDLE-TAXI	12.45	.47	.06	1.94	78.5	9.77	26.61	188	23.41	9.39
TOTALS			3.09	100.00		36.72	100.01		249.20	100.00
GTSIO-520-H										
1 - COLD START	8.16	.54	.04	1.79	15.2	1.24	11.78	366	29.87	9.02
2 - IDLE-TAXI-LOW	8.16	.40	.03	1.35	31.5	2.57	24.41	236	19.26	5.82
3 - IDLE-TAXI-HIGH	12.24	.45	.06	2.69	15.8	1.93	18.33	335	41.00	12.39
4 - RUN-UP	8.16	.85	.07	3.14	10.6	.86	8.17	399	32.56	9.84
5 - TAKE-OFF	1.72	.47	.01	.45	4.6	.08	.76	475	8.17	2.47
6 - CLIMB-RICH	12.37	1.39	.17	7.62	3.3	.41	3.89	428	52.94	15.99
7 - CLIMB-LEAN	12.24	7.68	.94	42.15	2.3	.28	2.66	235	28.76	8.69
8 - PATTERN	24.49	3.5	.86	38.57	3.4	.83	7.88	317	77.63	23.45
9 - IDLE-TAXI	12.45	.39	.05	2.24	18.7	2.33	22.13	328	40.84	12.34
TOTALS			2.23	100.00		10.53	100.01		331.03	100.01

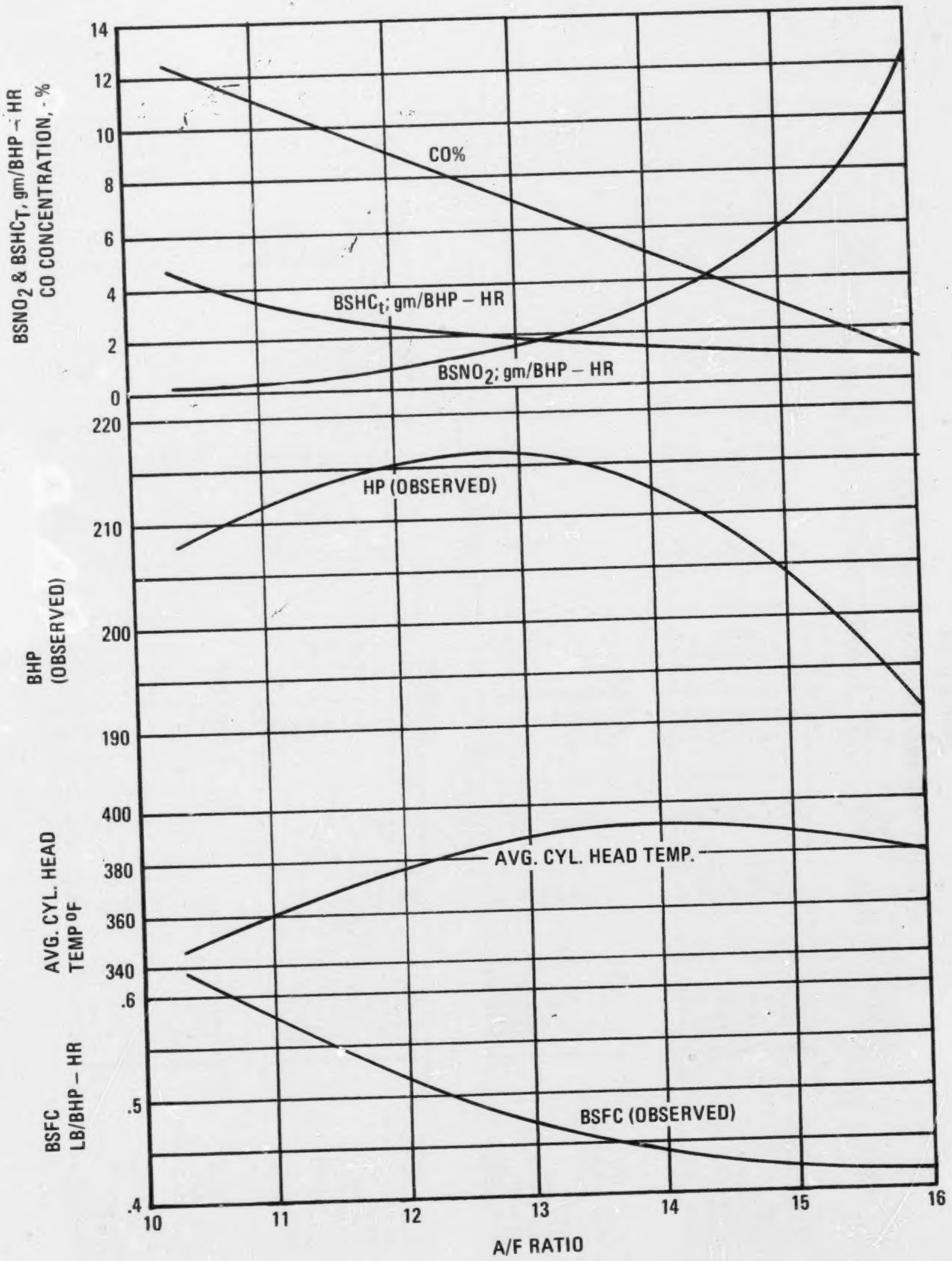


Figure 9.1 Emissions and Engine Performance at Take-off Versus A/F Ratio, O-470-R S/N 211333.

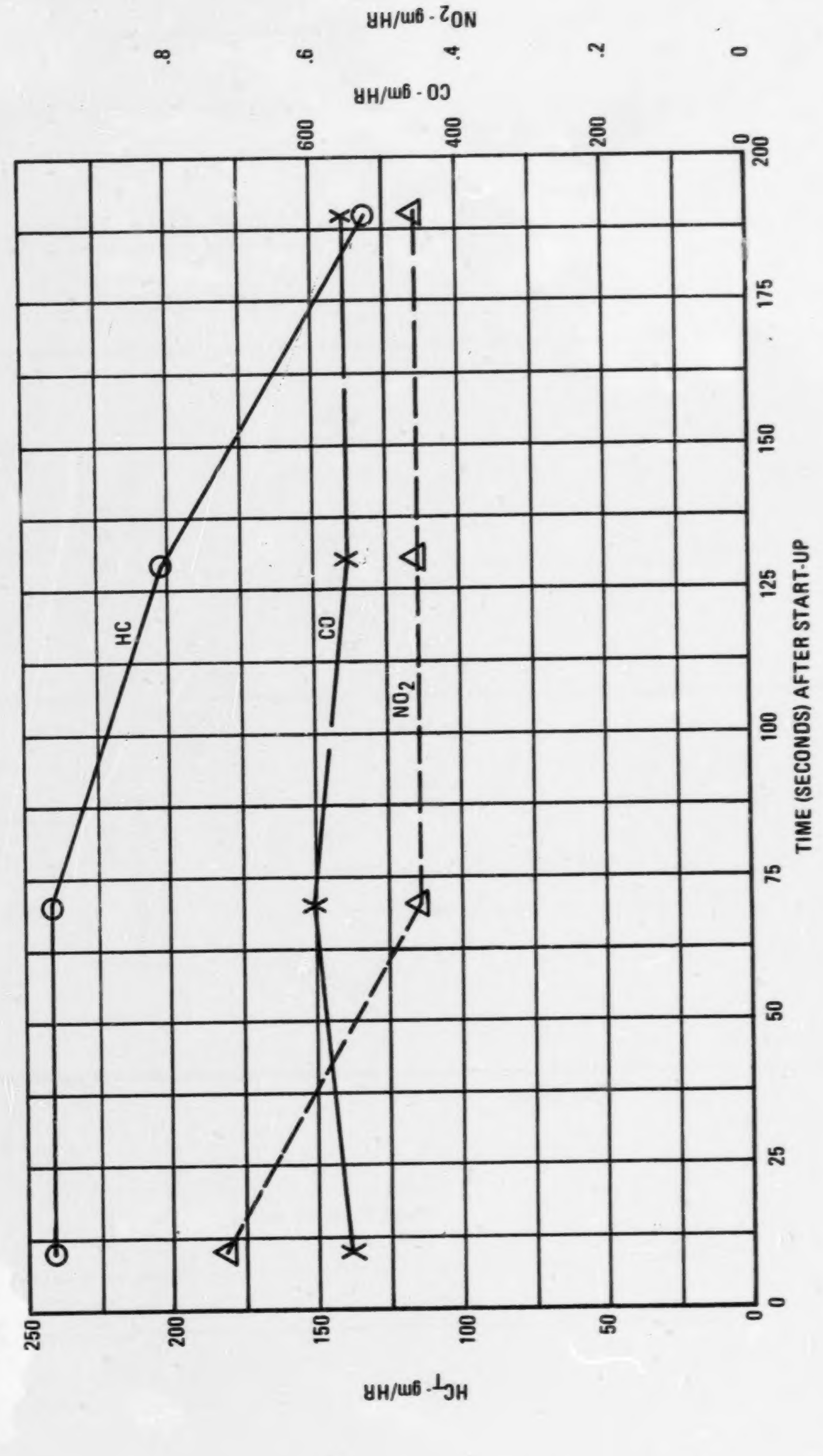
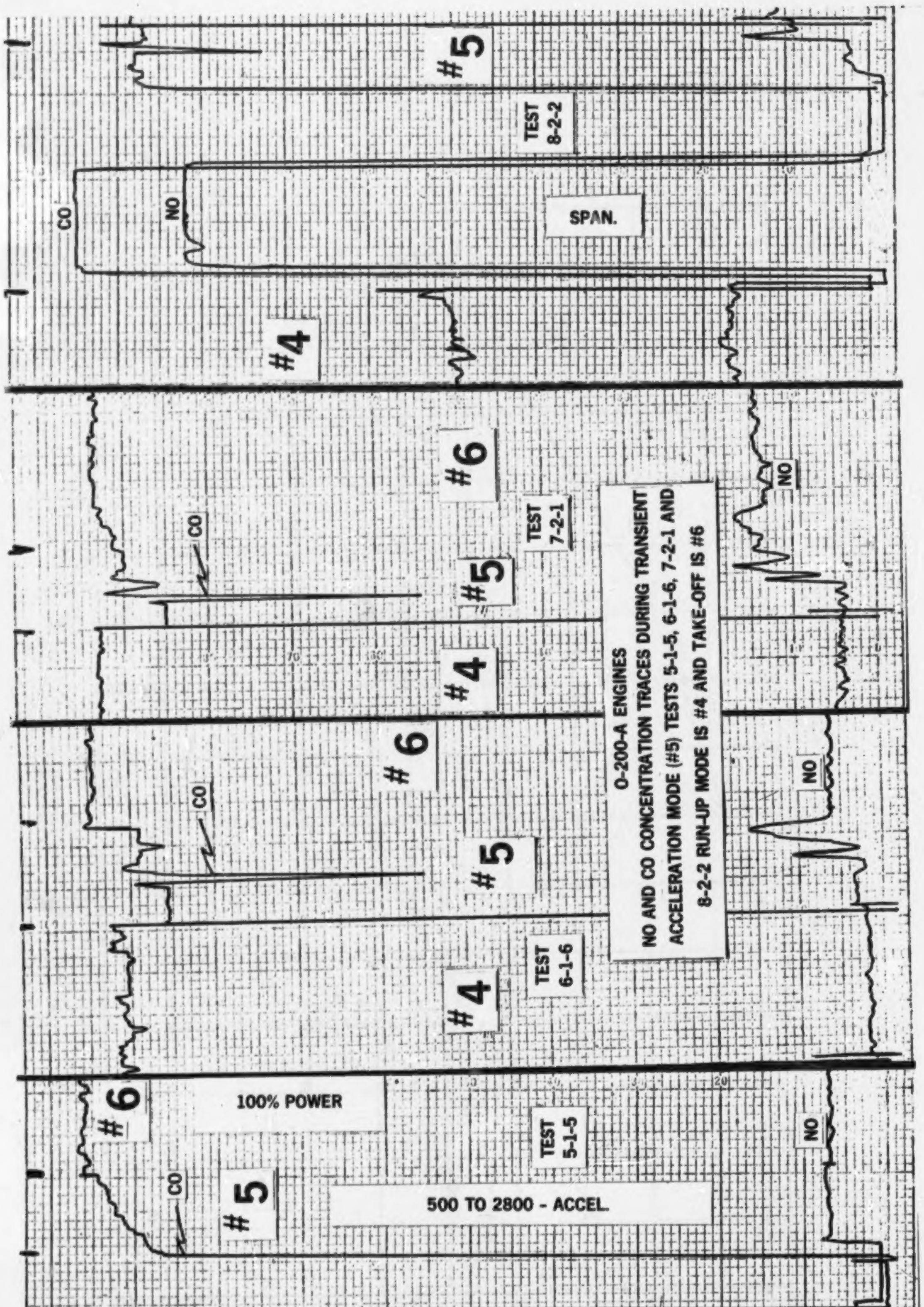
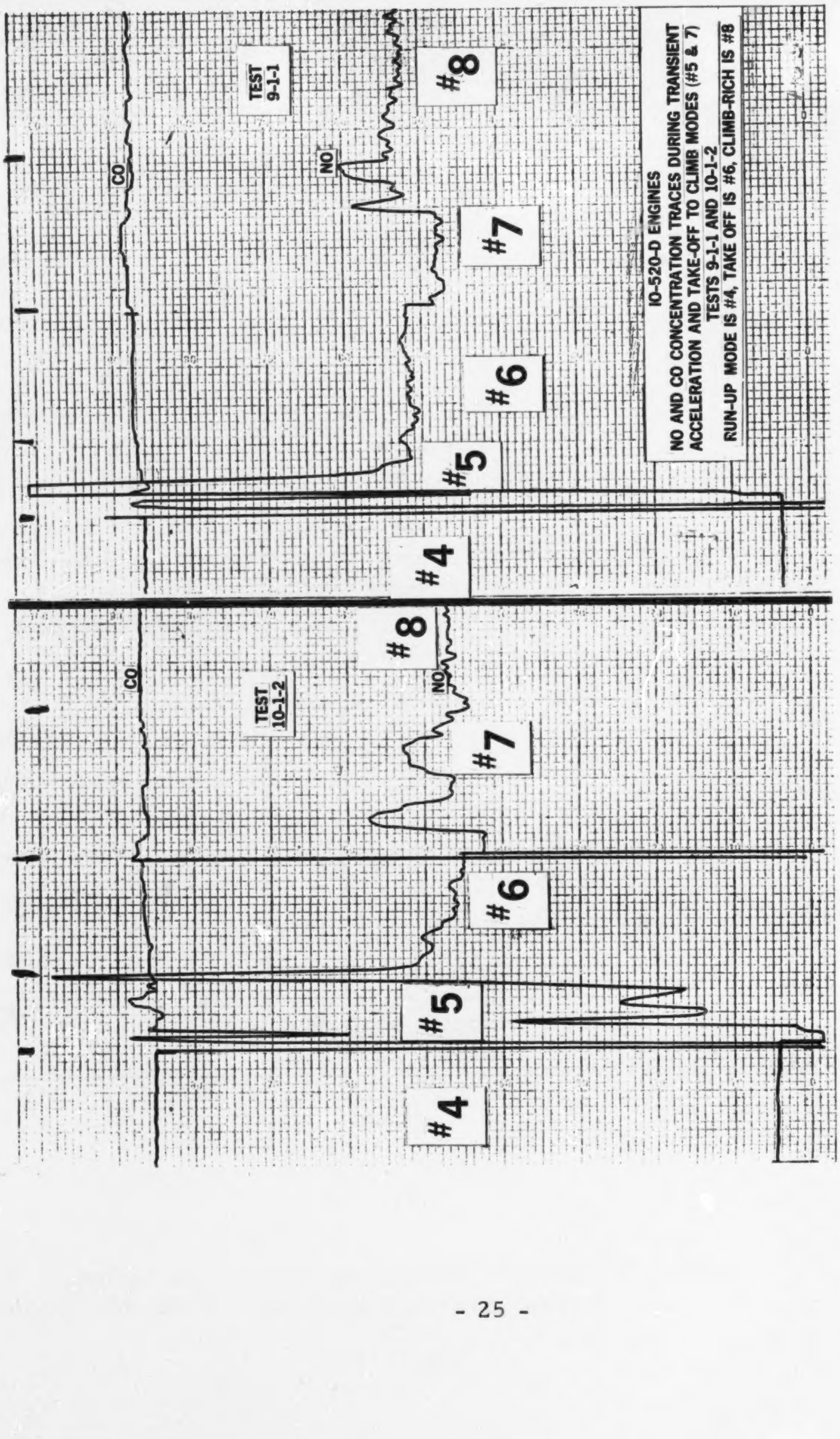


Figure 9.2 Cold Start Mass Emissions as a Function of Time, O-200-A, S/N 213504, Test 7-2-1.



O-200-A ENGINES
NO AND CO CONCENTRATION TRACES DURING TRANSIENT
ACCELERATION MODE (#5) TESTS 5-1-5, 6-1-6, 7-2-1 AND
8-2-2 RUN-UP MODE IS #4 AND TAKE-OFF IS #6

Figure 9.3 O-200-A NO and CO Concentration Traces.



IO-520-D ENGINES
NO AND CO CONCENTRATION TRACES DURING TRANSIENT ACCELERATION AND TAKE-OFF TO CLIMB MODES (#5 & 7)
TESTS 9-1-1 AND 10-1-2
RUN-UP MODE IS #4, TAKE OFF IS #6, CLIMB-RICH IS #8

Figure 9.4 IO-520-D NO and CO Concentration Traces.

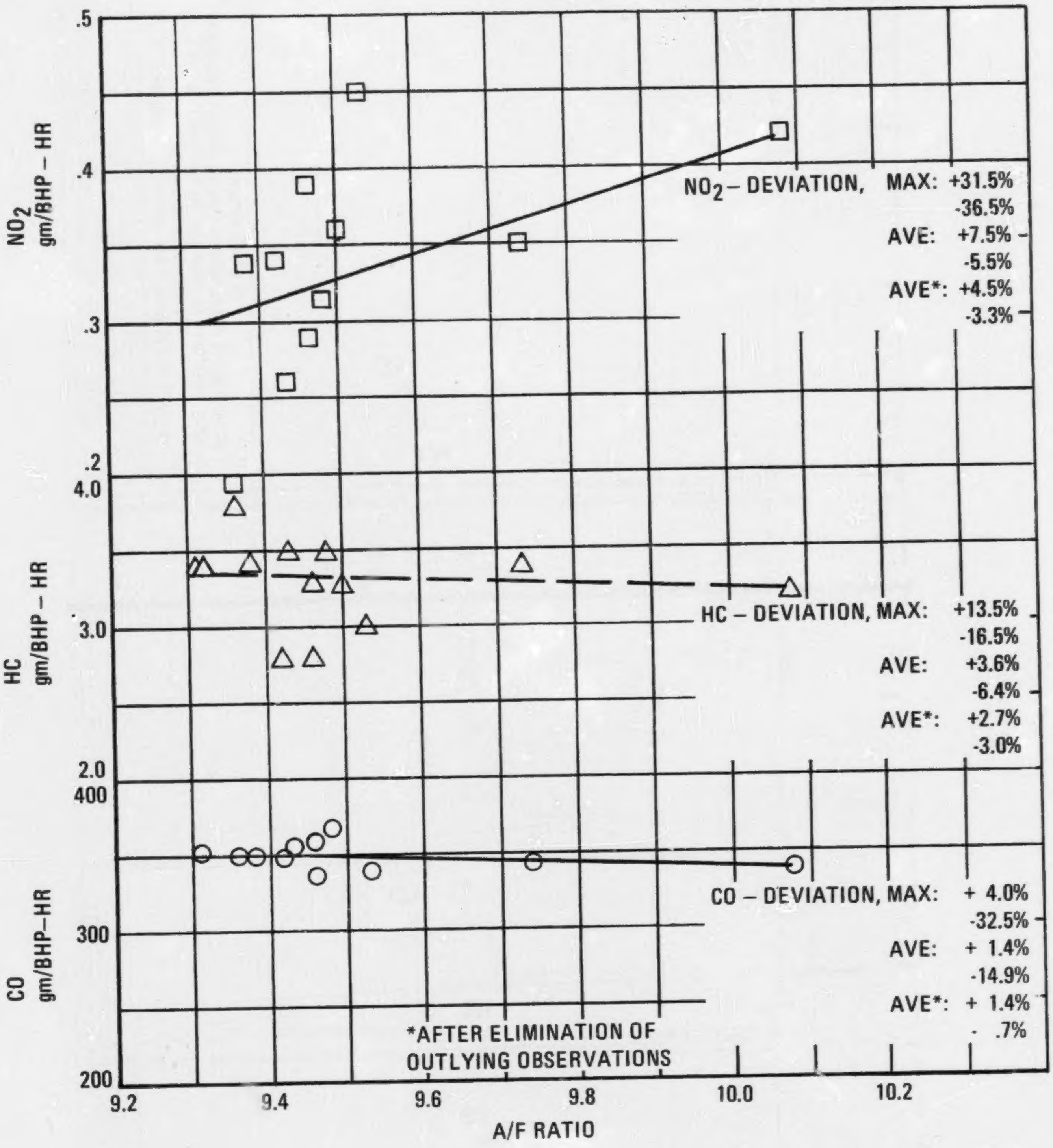


Figure 9.5 Take-Off Mode Brake Specific Emissions Versus Air/Fuel Ratio with GTSIO-520 Engines

SECTION 10
APPENDIX A

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AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%	
~~COLD START~~	~~10SEC~~	2.50	45.9	5.5	25	2500	6.2	LEFT BANK
	~~70SEC~~	30.60	225	23.0	25	0	6.4	
	~~130SEC~~	89.20	558	51.0	62	1200	11.4	
	~~190SEC~~	2.70	36	5.3	18	0	6.9	RIGHT BANK
~~IDLE-TAXI-LOW~~		30.8	225	24.2	15	0	4.0	
~~IDLE-TAXI-HIGH~~		92.2	558	52.0	75	0	6.9	
RUN-UP								
ACCEL TO 100%		0						
TAKE OFF 100%								
TAKE OFF TO CLIMB		0						
CLIMB-RICH								
CLIMB-LEAN								
PATTERN								
IDLE-TAXI								
SHUTDOWN		0						
HOT START		0						

ENGINE MODEL 0-200-A
ENGINE S/N 213457
TEST NUMBER 4 - 1 - 4
SPECIAL 'THREE SPEEDS, TWO SIDES
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 6-18-71
TESTED BY Fuller · Marshall
COMPUTER DATA PREPARED BY: Reque:RU DATE: 6-19
COMPUTER DATA PROCESSED BY: Reque:RU DATE: 6-19
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.90 "HG
SPECIFIC HUMIDITY: 77 grains/# DRY AIR
RELATIVE HUM. CORR. FACTOR WRH: 1.09%

ORDER OF READING RESULTS →

	MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	COLD START	10SEC												
		70SEC												
		130SEC												
		190SEC												
LEFT BANK	~~IDLE-TAXI-LOW~~		51.4	9.3	.745	.783	.142	.313	33.6	6.1	13.4	1181	214	472
	~~IDLE-TAXI-HIGH~~		248	9.7	.783	3.8	.167	.125	—	—	—	5999	260	194
	~~RUN-UP~~		609	10.9	.806	23	.442	.264	181	3.5	2.0	26394	517	295
	ACCEL TO 100%													
	TAKE OFF 100%													
	TAKE OFF TO CLIMB													
RIGHT BANK	~~CLIMB-RICH~~		41.3	6.7	.687	.431	.081	159	—	—	—	1006	189	372
	~~CLIMB-LEAN~~		249	9.2	.771	2.3	.095	.075	—	—	—	3750	154	121
	~~PATTERN~~		610.	10.7	802	29	.549	.310	—	—	—	15992	307	173
	IDLE-TAXI													
	SHUTDOWN													
	HOT START													

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL O-200-A
ENGINE S/N 213457
TEST NUMBER 5 a : 1 b : 5 c

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE
TESTED BY MARSHALL FULLER
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6-19
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6-19
RESULTS REVISED BY: DATE:

CORRECTED BAROMETER: 28.96 "HG
SPECIFIC HUMIDITY: 73 grains/# DRY AIR
RELATIVE HUMIDITY CORRECTION FACTOR WRH: 1.01%

→ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
COLD START	10SEC	0	27	3.4	30	0	6.4
	70SEC	0	27	4.0	40	0	6.4
	130SEC	0	27	4.0	40	0	5.9
	190SEC	0	27	4.0	30	0	5.9
IDLE-TAXI-LOW		2.6	45	5.4	25	0	6.2
IDLE-TAXI-HIGH		6.5	72	8.2	30	0	6.9
RUN-UP		20.4	153	13.8	35	0	7.4
ACCEL TO 100%		0					
TAKE OFF 100%		89.4	558	55.0	59	0	10.2
TAKE OFF TO CLIMB		0					
CLIMB-RICH		1	1	1	0	0	0
CLIMB-LEAN		88.8	558	51.0	59	0	9.7
PATTERN		30.0	216	23.0	25	0	5.4
IDLE-TAXI		7.2	72	9.0	25	0	9.7
SHUTDOWN		0					
HOT START		0	27	4.0	35	0	9.7

→ORDER OF READING RESULTS →

MODE		A+F	A/F	1-Æ/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
COLD START	10SEC	30	7.9	.733	.551	.162		—	—		714	210	
	70SEC	31	6.7	.685	.719	.179		—	—		699	174	
	130SEC	31	6.7	.685	.719	.179		—	—		644	161	
	190SEC	31	6.7	.685	.539	.134					644	161	
IDLE-TAXI-LOW		50	8.3	.745	.768	.142	.295	—	—	—	1185	214	445
IDLE-TAXI-HIGH		80	8.7	.758	1.478	.180	.227	—	—	—	2067	252	318
RUN-UP		166	11	.808	3.6	.264	.178	—	—	—	4693	340	230
ACCEL TO 100%													
TAKE OFF 100%		611	10	.798	22	.424	.251	—	—	—	2366	44	26
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		609	10	.806	22	.440	.253	—	—	—	22458	440	252
PATTERN		239	9.3	.774	3.7	.160	.123	—	—	—	4860	211	162
IDLE-TAXI		81	8.0	.735	1.2	.136	.170	—	—	—	2890	321	401
SHUTDOWN													
HOT START		31	6.7	.685	.629	.157		—	—		1060	265	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-200-A
ENGINE S/N 213457
TEST NUMBER 6 (a) - 1 (b) - 6 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 6-18-71
TESTED BY Fuller Marshall
COMPUTER DATA PREPARED BY: Regueiru DATE: 6-19
COMPUTER DATA PROCESSED BY: Regueiru DATE: 6-19
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.92 "HG
SPECIFIC HUMIDITY: 79 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.11%

→ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO%
COLD START	10 SEC	0	27	4.0	20	0	6.0
	70 SEC	0	27	4.0	25	0	5.7
	130 SEC	0	27	4.0	25	0	5.4
	190 SEC	0	27	4.0	25	0	5.4
IDLE-TAXI-LOW		2.1	45	5.3	10	0	5.4
IDLE-TAXI-HIGH		7.0	72	6.3	10	0	6.4
RUN-UP		20.1	162	15.0	20	0	7.8
ACCEL TO 100%		0					
TAKE OFF 100%		89.6	558	52.0	100	0	9.5
TAKE OFF TO CLIMB		0					
CLIMB-RICH		88.3	558	50.0	55	0	9.5
CLIMB-LEAN		87.5	558	50.0	55	0	9.5
PATTERN		28.0	207	23.0	25	0	5.3
IDLE-TAXI		9.3	63	10.0	25	0	6.9
SHUTDOWN		0					
HOT START		0	18	4.0	40	0	5.4

→ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10 SEC	31	6.7	.685	.359	.089		—	—		655	163	
	70 SEC	31	6.7	.685	.449	.112		—	—		623	155	
	130 SEC	31	6.7	.685	.449	.112		—	—		590	147	
	190 SEC	31	6.7	.685	.449	.112		—	—		590	147	
IDLE-TAXI-LOW		50	8.4	.750	.307	.058	.146	—	—	—	1009	190	480
IDLE-TAXI-HIGH		78	11	.814	.489	.077	.069	—	—	—	1906	302	272
RUN-UP		177	10	.803	2.2	.147	.110	—	—	—	5246	349	261
ACCEL TO 100%													
TAKE OFF 100%		610	10	.802	38	.733	.425	—	—	—	22019	423	245
TAKE OFF TO CLIMB													
CLIMB-RICH		608	11	.810	20	.418	.236	—	—	—	21967	439	248
CLIMB-LEAN		608	11	.810	20	.418	.239	—	—	—	21967	439	251
PATTERN		230	9.0	.764	3.5	.154	.126	—	—	—	4569	198	163
IDLE-TAXI		73	6.3	.663	1.0	.103	.111	—	—	—	1734	173	186
SHUTDOWN													
HOT START		22	4.5	.528	.413	.103		—	—		339	84	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-200-A
ENGINE S/N 213504
TEST NUMBER 7 (a) : 2 (b) : 1 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-21-71
TESTED BY FULLER · MARSHALL
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6-21
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6-21
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.91 "HG
SPECIFIC HUMIDITY: 63 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .89%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC$_T$	CO%
COLD START	10 SEC	0	27	3.5	40	30000	5.0
	70 SEC	0	27	3.5	25	30000	5.4
	130 SEC	0	27	3.5	25	25000	5.0
	190 SEC	0	27	3.5	25	17500	5.0
IDLE-TAXI-LOW		2.8	40.5	4.6	10	27500	6.4
IDLE-TAXI-HIGH		8.0	76.5	8.2	35	17500	7.3
RUN-UP		20.3	157.5	15.5	35	4000	8.7
ACCEL TO 100%		0					
TAKE OFF 100%		91.3	576.0	53.0	115	-0-	9.3
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		91.1	567	51	150	-0-	8.7
PATTERN		29.3	207	22	25	-0-	6.9
IDLE-TAXI		7.4	67.5	7.5	25	-0-	5.4
SHUTDOWN		0					
HOT START		0	22.5	3.5	40	-0-	5.4

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-α F/A	NO$_2$			HC$_T$			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10 SEC	30	7.7	.725	.732	.209		242	69		556	159	
	70 SEC	30	7.7	.725	.458	.130		242	69		601	171	
	130 SEC	30	7.7	.725	.458	.130		202	57		556	159	
	190 SEC	30	7.7	.725	.458	.130		741	40		556	159	
IDLE-TAXI-LOW		45	8.8	.759	.277	.060	.099	321	69	114	1078	234	385
IDLE-TAXI-HIGH		84	9.3	.772	1.8	.223	.229	379	46	47	2327	283	290
RUN-UP		173	10	.791	3.7	.243	.185	174	11	8.5	5704	368	281
ACCEL TO 100%													
TAKE OFF 100%		629	10	.804	45	.853	.495	—	—	—	22235	419	243
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		618	11	.809	57	1.1	.636	—	—	—	20447	400	224
PATTERN		229	9.4	.774	3.5	.161	.121	—	—	—	5952	270	203
IDLE-TAXI		75	9.0	.764	1.1	.154	.156	—	—	—	1518	202	205
SHUTDOWN													
HOT START		26	6.4	.670	.593	.169		—	—		487	139	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL O-200-A
ENGINE S/N 213504
TEST NUMBER 8 - 2 - 2 (a - b - c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-21-71
TESTED BY FULLER MARSHALL
COMPUTER DATA PREPARED BY: LEQUEIR DATE: 6-21
COMPUTER DATA PROCESSED BY: LEQUEIR DATE: 6-21
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.91 "HG
SPECIFIC HUMIDITY: 65 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .92%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO%
COLD START	10 SEC	0	27.0	3.5	35	0	7.4
	70 SEC	0	27.0	3.5	35	0	7.8
	130 SEC	0	27.0	3.5	25	0	8.2
	190 SEC	0	27.0	3.5	35	0	8.7
IDLE-TAXI-LOW		2.0	36.0	4.3	10	0	7.4
IDLE-TAXI-HIGH		6.8	67.5	7.6	25	0	5.3
RUN-UP		19.6	153.0	13.2	130	0	.6
ACCEL TO 100%		0					
TAKE OFF 100%		91.1	571.5	53.0	90	0	6.4
TAKE OFF TO CLIMB		0					
CLIMB-RICH		91.1	571.5	53.0	90	0	6.4
CLIMB-LEAN		90.3	567	51.0	130	0	5.4
PATTERN		28.8	202.5	22.0	20	0	8.5
IDLE-TAXI		7.0	67.5	6.5	30	0	4.9
SHUTDOWN		0					
HOT START		0	22.5	3.5	40	0	7.8

→ORDER OF READING RESULTS→

MODE		A+F	A/F	$1-\alpha F/A$	NO$_2$			HC$_T$			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10 SEC	30	7.7	.725	.641	.183		—	—		824	235	
	70 SEC	30	7.7	.725	.641	.183		—	—		868	248	
	130 SEC	30	7.7	.725	.458	.130		—	—		913	260	
	190 SEC	30	7.7	.725	.641	.183					969	276	
IDLE-TAXI-LOW		40	8.3	.746	.245	.057	.122	—	—	—	1100	250	550
IDLE-TAXI-HIGH		75	8.8	.761	1.1	.152	.169	—	—	—	1489	195	219
RUN-UP		166	11	.817	13	1.0	.689	—	—	—	379	28	19
ACCEL TO 100%													
TAKE OFF 100%		624	10	.803	35	.662	.385	—	—	—	15188	286	166
TAKE OFF TO CLIMB													
CLIMB-RICH		624	10	.803	35	.662	.385	—	—	—	15188	286	166
CLIMB-LEAN		618	11	.809	50	.985	.556	—	—	—	12691	248	140
PATTERN		224	9.2	.769	2.7	.126	.096	—	—	—	7171	325	249
IDLE-TAXI		74	10	.795	1.3	.213	.197	—	—	—	1375	211	196
SHUTDOWN													
HOT START		26	6.4	.670	.593	.169		—	—		703	201	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 10-520-D
ENGINE S/N 159850
TEST NUMBER 9 : 1 : 1 (a : b : c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-21-71
TESTED BY Marshall-Fuller
COMPUTER DATA PREPARED BY: Pequeiro DATE: 6-22
COMPUTER DATA PROCESSED BY: Pequeiro DATE: 6-22
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.96 "HG
SPECIFIC HUMIDITY: 63 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .88%

→ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO%
COLD START	10 SEC	0	85.5	11	-0-	0	7.4
	70 SEC	0	81.0	10.7	40	0	7.4
	130 SEC	0	81.0	10.6	47	0	7.4
	190 SEC	0	81.0	10.6	40	0	6.9
IDLE-TAXI-LOW		1.9	85.5	11.0	35	0	5.9
IDLE-TAXI-HIGH		4.6	130.5	16.0	25	0	5.4
RUN-UP		24.0	306.0	36.0	30	0	5.4
ACCEL TO 100%		0					
TAKE OFF 100%		263.7	1566.0	145.0	460	0	6.1
TAKE OFF TO CLIMB		0					
CLIMB-RICH		202.1	1188.0	110.0	470	0	6.1
CLIMB-LEAN		202.9	1183.5	92.0	-0-	0	1.0
PATTERN		35.4	378.0	45.0	-0-	0	8.1
IDLE-TAXI		4.6	117.0	16.0	30	0	5.9
SHUTDOWN		0					
HOT START		0	81.0	10.5	25	0	8.1

→ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO$_2$			HC$_T$			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10 SEC	96	7.7	.727	—	—		—	—		2612	237	
	70 SEC	91	7.5	.719	2.1	.205		—	—		2467	230	
	130 SEC	91	7.6	.722	2.5	.243		—	—		2470	233	
	190 SEC	91	7.6	.722	2.1	.207					2303	217	
IDLE-TAXI-LOW		96	7.7	.727	2.0	.184	1.0	—	—	—	2082	189	1096
IDLE-TAXI-HIGH		146	8.1	.740	2.2	.139	.483	—	—	—	2921	182	635
RUN-UP		342	8.5	.750	6.2	.174	.261	—	—	—	6867	190	286
ACCEL TO 100%													
TAKE OFF 100%		1711	10.8	.803	491	3.3	1.8	—	—	—	39665	273	150
TAKE OFF TO CLIMB													
CLIMB-RICH		1298	10.8	.803	381	3.5	1.9	—	—	—	30091	273	148
CLIMB-LEAN		1275	12.9	.835	—	—	—	—	—	—	4839	52	23
PATTERN		423	8.4	.747	—	—	—	—	—	—	12716	282	359
IDLE-TAXI		133	7.3	.710	2.3	.147	.514	—	—	—	2830	176	615
SHUTDOWN													
HOT START		91	7.7	.725	1.3	.130		—	—		2706	257.	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
COLD START	10 SEC	0	81	10.5	-0-	-0-	-0-
	70 SEC	0	81	10.7	50	0	7.8
	130 SEC	0	81	10.8	55	0	7.6
	190 SEC	0	81	10.7	50	0	7.4
IDLE-TAXI-LOW		1.9	85.5	12.3	35	0	6.9
IDLE-TAXI-HIGH		4.8	121.5	15.2	42	0	6.2
RUN-UP		24.2	313.5	37.0	47	0	5.2
ACCEL TO 100%		0					
TAKE OFF 100%		264.2	1633.5	145.0	410	0	5.4
TAKE OFF TO CLIMB		0					
CLIMB-RICH		202.3	1197.0	111.0	410	0	5.9
CLIMB-LEAN		203.3	1192.5	92.0	-0-	0	.8
PATTERN		35.8	369.0	48.0	35	0	6.2
IDLE-TAXI		4.5	112.5	14.5	42	0	5.9
SHUTDOWN		0					
HOT START		0	81.0	10.5	55	0	7.8

ENGINE MODEL 10-520-D
ENGINE S/N 15C850
TEST NUMBER 10 (a) : 1 (b) : 2 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-21-71
TESTED BY FULLER - MARSHALL
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6-22
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6-22
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.94"HG
SPECIFIC HUMIDITY: 63 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .88%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
COLD START	10 SEC	91.5	7.7	.725	—	—		—	—		—	—	
	70 SEC	91.7	7.5	.719	2.7	.256		—	—		2601	243	
	130 SEC	91.8	7.5	.717	3.01	.279		—	—		2531	243	
	190 SEC	91.7	7.5	.719	2.71	.256		—	—		2467	230	
IDLE-TAXI-LOW		97.8	6.9	.695	2.0	.162	1.05	—	—	—	2400	195	1263
IDLE-TAXI-HIGH		136.7	7.9	.734	3.4	.228	.723	—	—	—	3117	205	649
RUN-UP		347.5	8.3	.747	9.9	.269	.411	—	—	—	6705	181	277
ACCEL TO 100%													
TAKE OFF 100%		1778	11.2	.811	456	3.1	1.7	—	—	—	36530	251	138
TAKE OFF TO CLIMB													
CLIMB-RICH		1308	10.8	.803	335	3.0	1.66	—	—	—	29327	264	145
CLIMB-LEAN		1284	12.9	.836	—	—	—	—	—	—	3897	42	19
PATTERN		417.0	7.6	.724	8.7	.182	.244	—	—	—	9485	196	263
IDLE-TAXI		127.0	7.7	.726	3.2	.221	.712	—	—	—	2739	188	608
SHUTDOWN													
HOT START		91.5	7.7	.725	3.0	.287		—	—		2606	248	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL I0-520-D
ENGINE S/N 159477
TEST NUMBER 11 - 2 - 1 (a, b, c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-22-71
TESTED BY Marshall - Fuller - Hartman
COMPUTER DATA PREPARED BY: Regueiro DATE: 6-22
COMPUTER DATA PROCESSED BY: Regueiro DATE: 6-22
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.94 "HG
SPECIFIC HUMIDITY: 63 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .90%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
COLD START	10SEC	0	81	13.2	-0-	-0-	-0-
	70SEC	0	81	11.5	150	47500	8.7
	130SEC	0	81	11.5	145	47500	8.7
	190SEC	0	81	11.5	150	50000	8.4
IDLE-TAXI-LOW		-!-	81	11.8	177	50000	8.4
IDLE-TAXI-HIGH		4.6	144	18.1	177	42500	5.2
RUN-UP		23.6	315	39.0	125	9000	11.6
ACCEL TO 100%		0					
TAKE OFF 100%		261.4	1597.5	154.0	205	2400	8.7
TAKE OFF TO CLIMB		0					
CLIMB-RICH		200.0	1192.5	123.0	175	2400	9.7
CLIMB-LEAN		204.8	1183.5	92.0	2250	1300	.9
PATTERN		37.3	396.0	46.0	55	11000	12.2
IDLE-TAXI		4.2	117.0	14.6	60	37500	5.4
SHUTDOWN		0					
HOT START		0	67.5	8.1	60	45000	7.3

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10SEC	94	6.1	.654	—	—		—	—		—	—	
	70SEC	92	7.0	.699	8.1	.708		1181	102		2873	249	
	130SEC	92	7.0	.699	7.8	.684		1181	102		2873	249	
	190SEC	92	7.0	.699	8.1	.708		1243	108		2774	247	
IDLE-TAXI-LOW		92	6.8	.691	9.5	.811	9.5	1252	106	1252	2762	234	2762
IDLE-TAXI-HIGH		162	7.9	.733	17	.958	3.7	1816	100	394	3098	171	673
RUN-UP		354	8.0	.737	26	.687	1.1	838	21	35	15136	388	641
ACCEL TO 100%													
TAKE OFF 100%		1751	10.	.795	224	1.4	.857	1055	6.8	4.0	57817	375	221
TAKE OFF TO CLIMB													
CLIMB-RICH		1315	9.6	.781	143	1.1	.715	803	6.5	4.0	48198	391	240
CLIMB-LEAN		1275	129	.835	1791	19	8.7	396	4.3	1.9	4355	47	21
PATTERN		442	8.6	.753	14	.323	.399	1264	27	33	20000	430	.530
IDLE-TAXI		131	8.0	.735	4.7	.327	1.1	1299	89	309	2615	179	622
SHUTDOWN													
HOT START		75	8.3	.745	2.7	.341		890	109		2045	252	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
COLD START	10SEC	0	76.5	9.5	—	—	—
	70SEC	0	76.5	9.6	325	50000	1.0
	130SEC	0	76.5	9.6	295	50000	.95
	190SEC	0	76.5	9.6	225	50000	1.0
IDLE-TAXI-LOW		2.6	81.5	10.5	112	50000	8.4
IDLE-TAXI-HIGH		6.1	135.0	17.2	85	42500	5.9
RUN-UP		26.6	315.0	37.0	68	9500	11.7
ACCEL TO 100%		0					
TAKE OFF 100%		262.8	1548.0	152.0	215	2500	8.8
TAKE OFF TO CLIMB		0					
CLIMB-RICH		206.2	1206.0	123.0	190	2300	9.2
CLIMB-LEAN		209.2	1188.0	92.0	2825	1200	.83
PATTERN		40.0	391.5	46.0	87	11000	12.2
IDLE-TAXI		5.7	117.0	14.2	100	50000	5.2
SHUTDOWN		0					
HOT START		0	47.5	10.0	110	50000	7.4

ENGINE MODEL 10-520-D
ENGINE S/N 159977
TEST NUMBER 12 : 2 : 2
(a) (b) (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-22-71
TESTED BY Marshall Fuller Hartman
COMPUTER DATA PREPARED BY: Resueiro DATE: 6-22
COMPUTER DATA PROCESSED BY: Resueiro DATE: 6-22
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.94 "HG
SPECIFIC HUMIDITY: 63 grains/# DRY AIR
RELATIVE HUMIDITY CORR. FACTOR WRH: .90%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-f/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
COLD START	10SEC	86.0	8.0	.736	—	—		—	—		—	—	
	70SEC	86.1	7.9	.733	16.9	1.7		1134	118		316	32	
	130SEC	86.1	7.9	.733	15.3	1.5		1134	118		300	31	
	190SEC	86.1	7.9	.733	11.7	1.2		1134	118		316	32	
IDLE-TAXI-LOW		92.0	7.7	.726	6.1	.590	2.38	1218	116	468	2826	269	1084
IDLE-TAXI-HIGH		152	7.8	.729	7.7	.453	1.27	1709	99	280	3291	191	539
RUN-UP		352.0	8.5	.750	14.6	.395	.550	871	23.5	32.7	15318	414	575
ACCEL TO 100%													
TAKE OFF 100%		1700	10.1	.791	227	1.4	.867	1070	7.0	4.0	56705	373	215
TAKE OFF TO CLIMB													
CLIMB-RICH		1329	9.8	.783	157	1.2	.761	776	6.3	3.7	46225	375	224
CLIMB-LEAN		1280	12.9	.835	2256	24.5	10.7	366	3.9	1.7	4030	43	19
PATTERN		437.5	8.5	.750	23.2	.506	.582	1250	27.0	31.0	19851	431	496
IDLE-TAXI		131.2	8.2	.742	7.9	.562	1.4	1719	121	301	2523	177	442
SHUTDOWN													
HOT START		77.5	6.7	.685	4.9	.494		1048	104		2022	202	

AIRCRAFT · EMISSIONS PROGRAM

ENGINE MODEL 0-200 A
ENGINE S/N 213483
TEST NUMBER 13 : 3 : 1

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-22-71
TESTED BY Fuller Marshall
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6-23
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6-23
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.93 "HG
SPECIFIC HUMIDITY: 64 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .90%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO%
COLD START	10SEC	0					
	70SEC	0					
	130SEC	0	22.5	3.5	42	20000	3.0
	190SEC	0					
IDLE-TAXI-LOW		2.7	45	4.0	42	4000	6.1
IDLE-TAXI-HIGH		7.5	81	7.5	70	3100	5.9
RUN-UP		20.9	171	12.4	445	500	.5
ACCEL TO 100%		0					
TAKE OFF 100%		93.3	576	52	225	1250	8.8
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		92.1	567	51	260	2250	8.6
PATTERN		29.0	207	21.5	4	1500	5.3
IDLE-TAXI		7.1	63	6.3	65	3000	6.1
SHUTDOWN		0					
HOT START		0	22.5	3.5	42	25000	7.4

→ORDER OF READING RESULTS→

MODE		A+F	A/F	1-∆F/A	NO_2			HC_T			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
COLD START	10SEC												
	70SEC												
	130SEC	26.0	6.4	.670	.623	.178		141	40		180	75	
	190SEC												
IDLE-TAXI-LOW		49.0	11.2	.811	1.2	.321	.476	48	12.0	17.9	1136	284	421
IDLE-TAXI-HIGH		88.5	10.8	.803	3.8	.516	.516	68	9.1	9.1	1984	264	264
RUN-UP		183.6	13.5	.843	50.8	4.0	2.4	21.6	1.7	1.0	347	27	16
ACCEL TO 100%													
TAKE OFF 100%		628	11.0	.808	88	1.6	.947	194	3.7	2.0	21015	404	226
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		618	11.1	.809	100	1.9	1.0	343	6.7	3.7	22562	442	244
PATTERN		228	9.6	.779	5.6	.263	.195	87	4.0	3.0	4570	210	150
IDLE-TAXI		69.3	10.0	.788	2.8	.445	.395	52	8.3	7.4	1600	254	225
SHUTDOWN													
HOT START		26.0	6.4	.670	.623	.178		177	50		667	190	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENTR. (PPM) NO	HC_T	CO %
	10 SEC	0					
	70 SEC	0					
	130 SEC	0	22.5	3.5	55	32500	3.5
	190 SEC	0					
IDLE-TAXI-LOW		2.1	45	4.0	60	3500	6.4
IDLE-TAXI-HIGH		6.6	81	10.5	45	7000	9.7
RUN-UP		18.6	153	15.7	85	1550	6.1
ACCEL TO 100%		0					
TAKE OFF 100%		89.1	562.5	51.5	175	2100	8.2
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		88.8	558	51	195	1750	8.6
PATTERN		28.3	207	21.5	70	900	5.2
IDLE-TAXI		6.6	67.5	11.8	35	950	11.2
SHUTDOWN		0					
HOT START		0	27.0	3.5	60	35000	5.4

ENGINE MODEL 0-200-A
ENGINE S/N 213500
TEST NUMBER 14 : 4 : 1
(a) (b) (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-23-71
TESTED BY FULLER MARSHALL
COMPUTER DATA PREPARED BY: Pereira DATE: 6-23
COMPUTER DATA PROCESSED BY: Pereira DATE: 6-23
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.71 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.18%

ORDER OF READING RESULTS →

MODE		A+F	A/F	$1-\alpha F/A$	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10 SEC												
	70 SEC												
	130 SEC	26.0	6.4	.670	.815	.233		230	66		316	90	
	190 SEC												
IDLE-TAXI-LOW		49.0	11.2	.811	1.83	.459	.875	42	10.5	20	1920	298	568
IDLE-TAXI-HIGH		91.5	7.7	.725	2.47	.235	.374	169	16.1	26	3241	308	491
RUN-UP		168.7	9.7	.782	8.91	.567	.479	46	4.2	3.5	3888	247	209
ACCEL TO 100%													
TAKE OFF 100%		614.0	10.9	.805	47.1	1.3	.754	320	6.2	3.5	19140	371	214
TAKE OFF TO CLIMB													
CLIMB-RICH		2.0	1.0	1.1	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		609	10.9	.806	74.2	1.4	.836	264	5.1	2.9	19911	390	224
PATTERN		228.5	9.6	.779	9.93	.461	.350	52.3	2.4	1.8	4485	208	158
IDLE-TAXI		79.3	5.7	.629	1.51	.128	.228	16.4	1.3	2.5	2938	249	445
SHUTDOWN													
HOT START		30.5	7.7	.725	1.09	.314		283	81		601	171	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 10-520-D
ENGINE S/N 159982
TEST NUMBER 15 (a) - 3 (b) - 1 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-23-71
TESTED BY FULLER - MARSHALL HARTMAN
COMPUTER DATA PREPARED BY REQUEIRO DATE: 6·24
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6·24
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.60 "HG
SPECIFIC HUMIDITY: 85 grains/# DRY AIR
REL. HUM CORR. FACTOR WRH: 1.20%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	81	10	100	20000	5.20
	190SEC	0					
IDLE-TAXI-LOW		2.3	99	10.5	150	10000	9.00
IDLE-TAXI-HIGH		5.4	130.5	14.3	110	3500	7.80
RUN-UP		25.4	288	31.0	140	2900	5.40
ACCEL TO 100%		0					
"TAKE" OFF 100%		259.8	1534.5	144	310	2000	6.65
TAKE OFF TO CLIMB		0					
CLIMB-RICH		205.9	1206.0	112	420	2000	5.70
CLIMB-LEAN		207.9	1188.0	92	2875	1600	.80
PATTERN		23.3	306	34.5	115	3600	8.10
IDLE-TAXI		5.0	112.5	13	85	7500	5.30
SHUTDOWN		0					
HOT START		0	63	8.3	90	39500	6.65

→ORDER OF READING RESULTS→

MODE		A+F	A/F	$1-\alpha F/A$	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	91	8.1	.738	5.5	.551		470	47		1745	174	
	190SEC												
IDLE-TAXI-LOW		109	9.4	.775	10.	.769	4.4	280	26	121	3713	353	1614
IDLE-TAXI-HIGH		144	9.1	.767	9.8	.687	1.8	130	9.1	24	4240	296	285
RUN-UP		319	9.2	.771	27	.891	1.0	237	7.6	9.3	6480	209	255
ACCEL TO 100%													
TAKE OFF 100%		1678.5	10.7	.801	325	2.2	1.25	837	5.8	3.2	42401	294	163
TAKE OFF TO CLIMB													
CLIMB-RICH		1318	10.8	.803	345	3.0	1.68	656	5.8	3.1	28548	254	138
CLIMB-LEAN		1280	12.9	.835	2296	24.9	11	489	5.3	2.3	3884	42	18
PATTERN		340	8.8	.760	24	.698	1.0	317	9.1	19.6	10318	299	447
IDLE-TAXI		125	8.6	.755	6.5	.503	1.3	244	18	48	2480	190	496
SHUTDOWN													
HOT START		.71	7.5	.720	3.8	.462		710	85		1725	207	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO%
COLD START	10 SEC	0					
	70 SEC	0					
	130 SEC	0	63	8.1	165	35000	1.0
	190 SEC	0					
IDLE-TAXI-LOW		1.8	81	10.3	208	22500	5.4
IDLE-TAXI-HIGH		4.8	121.5	13.4	70	7500	6.6
RUN-UP		23.5	279.0	30.5	90	3300	6.6
ACCEL TO 100%		0					
TAKE OFF 100%		263	1561.5	146.0	295	2300	7.1
TAKE OFF TO CLIMB		0					
CLIMB-RICH		207.3	1224.0	112.0	400	2000	5.9
CLIMB-LEAN		209.5	1210.5	92.0	2625	1500	1.0
PATTERN		38.0	360.0	37.0	115	3800	8.3
IDLE-TAXI		5.0	117.0	12.8	75	7500	5.2
SHUTDOWN		0					
HOT START		0	65.0	7.5	80	37500	6.6

ENGINE MODEL IO-520-D
ENGINE S/N 159982
TEST NUMBER 16 : 3 : 2
a b c

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-23-71
TESTED BY FULLER-MARSHALL
COMPUTER DATA PREPARED BY: REGUEIRO DATE: 6-24
COMPUTER DATA PROCESSED BY: REGUEIRO DATE: 6-24
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.60 "HG
SPECIFIC HUMIDITY: 85 grains/# DRY AIR
REL. HUM. CORR. FACTOR W$_{RH}$: 1.20%

ORDER OF READING RESULTS →

MODE		A+F	A/F	$1-\alpha F/A$	NO$_2$ gm/HR	NO$_2$ gm/# FUEL	NO$_2$ gm/BHP-HR	HC$_T$ gm/HR	HC$_T$ gm/# FUEL	HC$_T$ gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
COLD START	10 SEC												
	70 SEC												
	130 SEC	71	7.7	.727	7.0	.871		658	81		260	32	
	190 SEC												
IDLE-TAXI-LOW		91	7.8	.730	11	1.1	6.3	542	52	301	1807	175	1004
IDLE-TAXI-HIGH		134	9.0	.766	5.8	.434	1.2	260	19.	54	3340	249	695
RUN-UP		309	9.1	.768	17	.564	.732	262	8.6	11	7671	251	326
ACCEL TO 100%													
TAKE OFF 100%		1707	10.7	.801	261	1.7	.993	979	6.7	3.7	46058	315	175
TAKE OFF TO CLIMB													
CLIMB-RICH		1336	10.9	.806	334	2.9	1.6	663	5.9	3.1	29966	267	144
CLIMB-LEAN		1302	13.2	.838	2131	23	10	464	5.0	2.2	4936	53	23
PATTERN		397	9.7	.782	28	.766	.746	383	10	10	12450	336	327
IDLE-TAXI		129	9.1	.768	6.0	.469	1.2	250	19	50	2534	198	506
SHUTDOWN													
HOT START		72	8.6	.755	3.5	.474		706	94		1784	237	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL IO-520-D
ENGINE S/N 159983
TEST NUMBER 17 a : 4 b : 1 c

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-24-71
TESTED BY FULLER MARSHALL
COMPUTER DATA PREPARED BY: REGUEIRO DATE: 6-24
COMPUTER DATA PROCESSED BY: REGUEIRO DATE: 6-24
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.76 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.18%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
COLD START	10 SEC	0					
	70 SEC	0					
	130 SEC	0	90	10.5	90	42500	5.4
	190 SEC	0					
IDLE-TAXI-LOW		1.7	108	11.3	90	36500	6.7
IDLE-TAXI-HIGH		4.8	148.5	16.0	105	23000	8.1
RUN-UP		23.7	306	34.5	125	7500	7.6
ACCEL TO 100%		0					
TAKE OFF 100%		255.7	1534.5	150	160	2600	9.9
TAKE OFF TO CLIMB		0					
CLIMB-RICH		201.6	1174.5	117	250	2400	7.6
CLIMB-LEAN		204.8	1161.0	92	2100	1600	6.1
PATTERN		35.8	387.0	43	80	9500	11.6
IDLE-TAXI		4.0	126.0	13.3	108	42500	8.8
SHUTDOWN		0					
HOT START		0	63.0	8.7	116	50000	9.0

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
COLD START	10 SEC												
	70 SEC												
	130 SEC	100	8.5	.752	5.5	.527		1112	105		2020	192	
	190 SEC												
IDLE-TAXI-LOW		119	9.5	.778	6.6	.589	3.9	1111	98	653	3010	260	1770
IDLE-TAXI-HIGH		164	9.2	.771	10	.667	2.2	970	60	202	5012	313	1044
RUN-UP		340	8.8	.760	26	.759	1.1	660	19	27	9681	280	408
ACCEL TO 100%													
TAKE OFF 100%		1684	10.2	.792	168	1.1	.657	1102	7.3	4.3	63228	421	247
TAKE OFF TO CLIMB													
CLIMB-RICH		1291	10.0	.788	201	1.7	.997	783	6.6	3.8	37171	317	184
CLIMB-LEAN		1253	12.6	.832	1643	17	8.0	481	5.2	2.3	29025	315	141
PATTERN		430	9.0	.764	21	.493	.592	1054	24	29	18696	434	522
IDLE-TAXI		139	9.4	.776	9.3	.701	2.3	1513	113	3.78	4620	347	1155
SHUTDOWN													
HOT START		71	7.2	.707	4.9	.565		959	110		2320	260	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL O-200-A
ENGINE S/N 213500
TEST NUMBER 18_a - 4_b - 2_c

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 6-24-71
TESTED BY Fuller Maryan Hartman
COMPUTER DATA PREPARED BY: Regueiro DATE: 6-28
COMPUTER DATA PROCESSED BY: Regueiro DATE: 6-28
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.68 "HG
SPECIFIC HUMIDITY: 91 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.27%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
	10sec	0					
	70sec	0					
	130sec	0	31.5	3.5	50	25000	8.60
	190sec	0					
IDLE-TAXI-LOW		2.0	45.0	4.5	45	5000	7.80
IDLE-TAXI-HIGH		7.0	85.5	9.0	50	8500	9.25
RUN-UP		19.1	166.5	16.7	65	2200	6.40
ACCEL TO 100%		0					
TAKE OFF 100%		88.6	580.5	52.5	150	2600	8.60
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		88.9	576	51.0	180	2000	8.30
PATTERN		28.7	216	22.5	55	2100	5.20
IDLE-TAXI		7.0	67.5	10.0	42	9000	10.70
SHUTDOWN		0					
HOT START		0	27.0	3.5	55	35000	5.20

→ORDER OF READING RESULTS→

MODE		A+F	A/F	1-f/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10sec												
	70sec												
	130sec	35.0	9.0	.764	1.07	.308		225	64		1128	322	
	190sec												
IDLE-TAXI-LOW		49.5	10.0	.788	1.38	.308	.693	62.5	13.9	31.2	1461	324	730
IDLE-TAXI-HIGH		94.5	9.5	.776	2.93	.325	.418	205	22.7	29.3	3295	366	470
RUN-UP		183.2	9.9	.789	7.41	.443	.388	101	6.1	5.3	4438	265	232
ACCEL TO 100%													
TAKE OFF 100%		633	11.0	.808	59.3	1.13	.670	407	7.7	4.5	20701	394	233
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		627.0	11.2	.812	70.6	1.38	.794	309	6.06	3.4	19795	388	222
PATTERN		238.5	9.6	.779	8.14	.361	.283	127	5.6	4.4	4680	208	163
IDLE-TAXI		77.5	6.7	.685	1.88	.188	.269	188	18.8	26.9	2923	292	417
SHUTDOWN													
HOT START		30.5	7.7	.725	1.00	.287		282	80		579	165	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL O-200-A
ENGINE S/N 213500
TEST NUMBER 19 - 4 - 3 (a, b, c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-24-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY: Pesqueira DATE: 6-28
COMPUTER DATA PROCESSED BY: Pesqueira DATE: 6-28
RESULTS REVISED BY: ____ DATE: ____

CORRECTED BAROMETER: 28.68 "HG
SPECIFIC HUMIDITY: 91 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.27%

→ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	27.0	3.5	50	39000	7.60
	190SEC	0					
IDLE-TAXI-LOW		2.1	40.5	4.0	42	5000	7.40
IDLE-TAXI-HIGH		6.6	76.5	9.0	42	9000	9.75
RUN-UP		14.6	144.0	13.3	55	2100	6.40
ACCEL TO 100%		0					
TAKE OFF 100%		89.0	562.5	52.3	185	2800	8.60
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		88.5	562.5	51.0	155	2000	8.60
PATTERN		28.5	211.5	22.5	50	2000	5.20
IDLE-TAXI		6.6	72.0	10.5	35	9500	10.20
SHUTDOWN		0					
HOT START		0	27.0	3.6	45	42000	5.40

→ORDER OF READING RESULTS →

MODE		A+F	A/F	$1-\alpha^{F/A}$	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	30.5	7.7	.725	.916	.261		315.	90		846	241	
	190SEC												
IDLE-TAXI-LOW		44.5	10.1	.790	1.16	.291	.554	56.1	14	26	1249	311	594
IDLE-TAXI-HIGH		85.5	8.5	.750	2.19	.244	.332	200	22	30	3099	344	469
RUN-UP		157.3	10.8	.804	5.4	.406	.275	82	6.1	4.1	3826	287	195
ACCEL TO 100%													
TAKE OFF 100%		614.8	10.7	.802	71.0	1.359	.798	428	8.1	4.8	20091	384	225
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		613.5	11.0	.807	59.4	1.16	.671	303	5.9	3.4	20062	393	224
PATTERN		234	9.4	.774	7.24	.322	.254	119	5.3	4.2	4583	203	160
IDLE-TAXI		82.5	6.8	.690	1.68	.160	.254	211	20	32	2981	283	451
SHUTDOWN													
HOT START		30.6	7.5	.717	.821	.228		342	95		599	144	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-200-A
ENGINE S/N 215474
TEST NUMBER 20 - 5 - 1 (a - b - c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-25-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY Requeiro DATE: 6-28
COMPUTER DATA PROCESSED BY: Requeiro DATE: 6-28
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.63 "HG
SPECIFIC HUMIDITY: 87 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.23%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO %
	10 SEC	0					
	70 SEC	0					
	130 SEC	0	27.0	3.5	40	27500	7.60
	190 SEC	0					
IDLE-TAXI-LOW		2.4	40.5	3.7	35	7500	5.70
IDLE-TAXI-HIGH		7.5	81.0	9.0	55	4200	7.40
RUN-UP		19.5	153.0	13.2	325	900	9.00
ACCEL TO 100%		0					
TAKE OFF 100%		91.0	562.5	52.5	140	1000	9.25
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		91.5	562.5	51.0	170	1800	8.60
PATTERN		29.1	202.5	21.5	55	1500	5.20
IDLE-TAXI		7.5	67.5	10.3	55	4000	7.40
SHUTDOWN		0					
HOT START		0	27.0	3.5	80	40 000	5.30

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO$_2$			HC$_T$			CO		
					gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR
	10 SEC												
	70 SEC												
	130 SEC	30	7.7	.725	.732	.209		222	63		846	241	
	190 SEC												
IDLE-TAXI-LOW		44	10	.806	.969	.261	.372	82	22	31	957	258	368
IDLE-TAXI-HIGH		90	9.0	.764	3.0	.339	.406	97	10	13	2496	277	332
RUN-UP		166	11	.817	33	2.5	1.7	36	2.7	1.8	5690	431	291
ACCEL TO 100%													
TAKE OFF 100%		615	10	.802	53	1.0	.591	153	2.9	1.6	21614	411	237
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		613	11	.807	65.	1.2	.712	273	5.3	2.9	20062	393	219
PATTERN		224	9.4	.774	7.6	.355	.262	85	3.9	2.9	4388	204	150
IDLE-TAXI		77	6.5	.676	2.4	.238	.327	84	8.2	11	7010	195	268
SHUTDOWN													
HOT START		30	7.7	.725	1.4	.418		323	92		590	168	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211305
TEST NUMBER 21 (a) - 1 (b) - 1 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-25-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6-28
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6-28
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 29.05 "HG
SPECIFIC HUMIDITY: 84 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.17%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENTR. (PPM) NO	HC_T	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	94.5	15.5	110	50000+	6.40
	190SEC	0					
IDLE-TAXI-LOW		2.0	126.0	18.0	125	50000+	6.90
IDLE-TAXI-HIGH		4.6	162.0	19.7	100	47500	9.75
RUN-UP		23.9	297.0	32.0	90	4500	8.80
ACCEL TO 100%		0					
TAKE OFF 100%		191.1	1345.5	133.0	92	3400	12.00
TAKE OFF TO CLIMB		0					
CLIMB-RICH		152.7	1044	88.0	350	1200	5.70
CLIMB-LEAN		153.8	1066.5	86.5	415	1000	5.30
PATTERN		39.0	373.5	34.0	120	2500	6.15
IDLE-TAXI		4.3	139.5	17.9	115	50000+	9.30
SHUTDOWN		0					
HOT START		0	81.0	14.5	160	50000+	9.90

→ORDER OF READING RESULTS→

MODE		A+F	A/F	1-α F/A	NO_2 gm/HR	NO_2 gm/# FUEL	NO_2 gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	110	6.0	.652	6.76	.436		1509	97.3		2394	154	
	190SEC												
IDLE-TAXI-LOW		144.	7.0	.697	10.5	.584	5.27	1937	107	968	3541	196	1770
IDLE-TAXI-HIGH		181.7	8.2	.742	11.0	.561	2.40	2263	114	492	6551	332	1424
RUN-UP		329.0	9.2	.771	18.3	.572	.766	379	11.8	15.8	10890	340	455
ACCEL TO 100%													
TAKE OFF 100%		1478	10.1	.790	84.7	.637	.443	1268	9.5	6.6	62223	505	351
TAKE OFF TO CLIMB													
CLIMB-RICH		1132	11.8	.821	247	2.81	1.62	331	3.7	2.1	24542	278	160
CLIMB-LEAN		1153	12.3	.828	299	3.45	1.94	278	3.2	1.8	23224	268	151
PATTERN		407.5	10.9	.807	30.5	.899	.784	252	7.4	6.4	9528	280	244
IDLE-TAXI		157.4	7.7	.727	10.8	.608	2.53	2082	116	484	4781	267	1111
SHUTDOWN													
HOT START		95.5	5.5	.620	8.22	.567		1325	91		3093	213	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211 302
TEST NUMBER 22 (a) - 2 (b) - 1 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-28-71
TESTED BY Fuller Marshal Hartman
COMPUTER DATA PREPARED BY: [illegible] DATE: 6-29
COMPUTER DATA PROCESSED BY: [illegible] DATE: 6-29
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.53 "HG
SPECIFIC HUMIDITY: 109 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.52%

→ORDER OF ENTERING DATA →

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO %
10 SEC	0					
70 SEC	0					
130 SEC	0	99	15.4	120	50000	7.65
190 SEC	0					
IDLE-TAXI-LOW	1.5	112	16.7	110	50000	7.80
IDLE-TAXI-HIGH	4.2	153	19.0	89	48000	9.75
RUN-UP	23.1	301.5	33.0	50	5000	11.00
ACCEL TO 100%	0					
TAKE OFF 100%	158.7	1323	130.	62	3000	12.20
TAKE OFF TO CLIMB	0					
CLIMB-RICH	155.3	1012.5	90	265	1500	6.15
CLIMB-LEAN	156.8	1035	86.5	360	1300	5.40
PATTERN	52.6	495	42.0	260	1600	5.30
IDLE-TAXI	4.0	139.5	17.1	90	50000	7.40
SHUTDOWN	0					
HOT START	0	103.5	15.5	122	50000	5.90

→ORDER OF READING RESULTS →

MODE	A+F	A/F	1-αF/A	NO$_2$			HC$_T$			CO		
				gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
10 SEC												
70 SEC												
130 SEC	114	6.4	.670	7.8	.508		1558	101		3036	197	
190 SEC												
IDLE-TAXI-LOW	133	7.0	.699	8.6	.516	5.7	1798	107	1199	3718	222	2478
IDLE-TAXI-HIGH	172	8.0	.736	9.2	.488	2.2	2172	114	517	6178	325	1470
RUN-UP	334	9.1	.767	10	.313	.447	430	13	18	13816	418	598
ACCEL TO 100%												
TAKE OFF 100%	1453	10	.791	56	.432	.353	1098	8.4	6.9	67189	516	423
TAKE OFF TO CLIMB												
CLIMB-RICH	1102	11	.811	182	2.0	1.1	407	4.5	2.6	25790	286	166
CLIMB-LEAN	1121	11	.822	252	2.9	1.6	354	4.1	2.2	23032	266	146
PATTERN	537	11	0.820	87.	2.0	1.6	209	4.9	3.9	10826	257	205
IDLE-TAXI	156	8.1	.740	5.7	.333	1.4	2056	120	514	4279	250	1069
SHUTDOWN												
HOT START	119	6.6	.682	8.390	.541		1612	104		2467	159	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211302
TEST NUMBER 23 (a) - 2 (b) - 2 (c) BEST POWER

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-28-71
TESTED BY FULLER MARSHALL
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 6.28
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 6.28
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.58 "HG
SPECIFIC HUMIDITY: 114 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.57%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC_T	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	81.0	8.5	60	20 000	5.2
	190SEC	0					
IDLE-TAXI-LOW		1.6	81.0	8.8	45	20000	5.2
IDLE-TAXI-HIGH		4.0	126.0	12.7	40	10000	5.9
RUN-UP		22.0	252.0	22	90	2200	5.9
ACCEL TO 100%		0					
TAKE OFF 100%		186.3	1305.0	130	60	3100	12.2
TAKE OFF TO CLIMB		152.9	~~102.6~~	~~91~~	~~220~~	~~1500~~	6.4
CLIMB-RICH		150.6	999	74	1050	1000	7.3
CLIMB-LEAN		154.0	1039.5	86.5	335	1300	5.3
PATTERN		37.0	346.5	32.0	80	1900	7.1
IDLE-TAXI		4.4	117.0	11.2	48	5500	5.2
SHUTDOWN		0					
HOT START		0	72.0	8.5	40	29000	5.2

← CLIMB-RICH

→ SPECIAL RUN
VERY LEAN CLIMB

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	89.5	9.5	.777	3.3	.391		456	53		1755	206	
	190SEC												
IDLE-TAXI-LOW		89.8	9.2	.769	2.4	.283	1.561	461	52	288	1754	199	1096
IDLE-TAXI-HIGH		138.7	9.9	.786	3.4	.271	.863	351	27	87	3090	243	774
RUN-UP		274	11.4	.814	15.4	.701	.701	148	6.7	6.7	6149	279	279
ACCEL TO 100%													
TAKE OFF 100%		1435.0	10.0	.788	53.6	.412	.287	1124.0	8.6	6.0	66300	510	355
TAKE OFF TO CLIMB													
CLIMB-RICH		1117.0	11.2	.811	153	1.6	1.0	413	4.5	2.7	27192	248	177
CLIMB-LEAN		1126	12.0	.823	235	2.7	1.5	355	4.1	2.3	22694	262	147
PATTERN		378.5	10.8	.804	18.9	.591	.511	178.8	5.5	4.8	10213	319	276
IDLE-TAXI		128.2	10.4	.797	3.8	.342	.873	176.	15.7	40.1	2530	225	575
SHUTDOWN													
HOT START		805	8.4	.749	1.9	.231		609	71		1555	183	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 311302
TEST NUMBER 24 - 2 - 3

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-28-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: MARSHALL DATE: 6-24
COMPUTER DATA PROCESSED BY: MARSHALL DATE: 6-24
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.52 "HG
SPECIFIC HUMIDITY: 114 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.57%

ORDER OF ENTERING DATA →

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
10 SEC	0					
70 SEC	0					
130 SEC	0	72.0	7.8	73	23500	4.90
190 SEC	0					
IDLE-TAXI-LOW	1.9	81.0	8.3	69	20000	5.10
IDLE-TAXI-HIGH	5.0	117.0	13.0	80	2700	6.90
RUN-UP	24.0	261.0	21.5	145	2000	7.80
ACCEL TO 100%	0					
TAKE OFF 100%	189.6	1318.5	130.0	100.5	2500	12.20
TAKE OFF TO CLIMB	0					
CLIMB-RICH						
CLIMB-LEAN						
PATTERN						
IDLE-TAXI						
SHUTDOWN	0					
HOT START	0					

ORDER OF READING RESULTS →

MODE	A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
10 SEC												
70 SEC												
130 SEC	79	9.2	.770	3.6	.461		481	61		1469	188	
190 SEC												
IDLE-TAXI-LOW	89	9.7	.782	3.8	.461	2.0	453	54	238	1721	207	905
IDLE-TAXI-HIGH	130	9.0	.764	6.4	.493	1.2	90	6.9	18	3362	258	672
RUN-UP	282	12	.825	25	1.1	1.0	136	6.3	5.7	8377	389	349
ACCEL TO 100%												
TAKE OFF 100%	1448	10	.790	90	.697	.478	913	7.0	4.8	66968	515	353
TAKE OFF TO CLIMB												
CLIMB-RICH												
CLIMB-LEAN												
PATTERN												
IDLE-TAXI												
SHUTDOWN												
HOT START												

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL O-470-R
ENGINE S/N 311302
TEST NUMBER 25_a : 2_b : 4_c

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 6-24-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY: Marshall DATE: 6-24
COMPUTER DATA PROCESSED BY: Lepeiko DATE: 7-6
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.76 "HG
SPECIFIC HUMIDITY: 103 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.43%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	81.0	9.8	60	32500	6.15
	190SEC	0					
IDLE-TAXI-LOW		1.9	94.5	10.7	55	30000	7.10
IDLE-TAXI-HIGH		4.9	126.0	14.1	50	13220	7.80
RUN-UP		24.0	283.5	30.0	60	3300	7.80
ACCEL TO 100%		0					
TAKE OFF 100%		193.6	1341.0	132	70	2600	12.20
TAKE OFF TO CLIMB		0					
CLIMB-RICH		158.0	1039.5	90.0	320	1300	5.70
CLIMB-LEAN		-1-	-1-	-1-	-0-	-0-	-0-
PATTERN		38.9	360.0	33.0	100.5	1900	5.40
IDLE-TAXI		5.0	117.0	14.8	40	12000	7.10
SHUTDOWN		0					
HOT START		1.40	76.5	8.9	70	57500	5.70

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	90	8.2	.743	3.3	.338		773	78		2066	210	
	190SEC												
IDLE-TAXI-LOW		105	8.8	.759	3.5	.332	1.8	817	76	430	2792	261	1469
IDLE-TAXI-HIGH		140	8.9	.762	4.3	.306	.880	478	33	97	4092	290	835
RUN-UP		313	9.4	.775	11.6	.388	.485	264	8.8	11	9215	307	383
ACCEL TO 100%													
TAKE OFF 100%		1473	10	.791	64	.486	.331	965	7.3	4.9	68107	515	351
TAKE OFF TO CLIMB													
CLIMB-RICH		1129	11	.816	226	2.5	1.4	360	4.0	2.2	24492	272	155
CLIMB-LEAN		—	—	—	—	—	—	—	—	—	—	—	—
PATTERN		393	10	.805	24	.748	.634	185	5.6	4.7	8067	244	207
IDLE-TAXI		131	7.9	.731	3.182	.215	.636	417	28	83	3435	232	687
SHUTDOWN													
HOT START		85	8.5	.753	3.6	.411		1277	143		1813	2031	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211280
TEST NUMBER 31 : 3 : 1
a b c
Full Rich
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-1-71
TESTED BY MARSHALL FULLER
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-7
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-7
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.72 "HG
SPECIFIC HUMIDITY: 91 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.29%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM)		CO%
					NO	HC_T	
	10SEC	0					
	70SEC	0					
	130SEC	0	85.5	11.3	65	30000	6.8
	190SEC	0					
IDLE-TAXI-LOW		2.3	103.5	12.0	60	30000	8.3
IDLE-TAXI-HIGH		6.9	135.0	14.3	48	8000	8.6
RUN-UP		33.1	333.0	32.0	100	2500	6.4
ACCEL TO 100%		0					
TAKE OFF 100%		188.3	1359.0	130	90	3500	12.2
TAKE OFF TO CLIMB		0					
CLIMB-RICH		155.2	1089	85	550	1500	4.4
CLIMB-LEAN		-1-	-1-	-1-	-0-	-0-	-0-
PATTERN		54.7	459	40	175	1400	4.4
IDLE-TAXI		6.4	135	14.3	60	16500	8.8
SHUTDOWN		0					
HOT START		0	81	9.5	85	45000	5.7

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-F/A	NO₂			HC_T			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	96.8	7.5	.719	3.7	.333		772	68		2393	211	
	190SEC												
IDLE-TAXI-LOW		115	8.6	.754	4.2	.353	1.8	901	75	391	3572	247	1553
IDLE-TAXI-HIGH		149	9.4	.775	4.4	.310	.643	.305	21	44	4838	338	701
RUN-UP		365	10.4	.796	22	.211	.688	228	7.1	6.9	8864	277	267
ACCEL TO 100%													
TAKE OFF 100%		1489	10.4	.7[illegible]7	83.6	.643	.444	932	7.1	4.9	68952	530	364
TAKE OFF TO CLIMB													
CLIMB-RICH		1174	12.8	.834	403	4.7	2.6	421	4.9	2.7	19603	238	126
CLIMB-LEAN		2.0	1.0	1.1	—	—	—	—	—	—	—	—	—
PATTERN		499	11.4	.815	54	1.3	.998	171	4.2	3.1	8352	208	162
IDLE-TAXI		149	9.4	.775	5.5	.388	.867	630	44	98	4950	346	723
SHUTDOWN													
HOT START		90.5	8.5	.751	4.7	.495		1061	111		1919	202	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211780
TEST NUMBER 32 - 3 - 2
BEST POWER
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-1-71
TESTED BY Fuller Marclall Hartman
COMPUTER DATA PREPARED BY: Pequeiro DATE: 7-7
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-7
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 2872 "HG
SPECIFIC HUMIDITY: 91 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.29%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	90	9.5	73	30000	6.85
	190SEC	0					
IDLE-TAXI-LOW		1.6	94.5	11.5	65	25000	7.20
IDLE-TAXI-HIGH		5.7	121.5	12.7	55	5500	6.40
RUN-UP		32.0	324	26.0	155	1800	7.45
ACCEL TO 100%		0					
TAKE OFF 100%		187.5	1350	138	100	2800	12.20
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		152.7	1071	77	1245	1100	7.45
PATTERN		51.8	432	38	155	1500	5.40
IDLE-TAXI		5.7	121.5	12.7	60	6500	5.90
SHUTDOWN		0					
HOT START		0	81	8.7	85	43500	5.90

→ORDER OF READING RESULTS→

MODE		A+F	A/F	1-αF/A	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	99.	9.4	.776	4.5	.474		762	80		2569	270	
	190SEC												
IDLE-TAXI-LOW		106	8.2	.742	4.1	.364	2.16	695	60	434	2822	245	1763
IDLE-TAXI-HIGH		134	9.5	.778	4.5	.360	.803	188	14	33	3240	255	568
RUN-UP		350	12	.829	33	1.3	.1.0	151	5.8	4.7	9906	381	309
ACCEL TO 100%													
TAKE OFF 100%		1480	10	.795	92	.710	.492	1039	7.9	5.5	68513	527	365
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		1148	13	.847	887	11	5.8	296	3.8	1.9	3229	419	211
PATTERN		470	11	.813	45	1.1	.879	173	4.5	3.3	9654	254	186
IDLE-TAXI		134	9.5	.778	4.9	.393	.876	222	17	39	2987	235	524
SHUTDOWN													
HOT START		89	9.3	.772	4.7	.542		1000	115		1991	228	

AIRCRAFT EMISSIONS PROGRAM

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	85.5	11.8	48	15000	6.75
	190 SEC	0					
IDLE-TAXI-LOW		-/-	103.5	12.0	48	17500	6.80
IDLE-TAXI-HIGH		-/-	144.0	15.2	40	7800	7.45
RUN-UP		-/-	342.0	31.5	105	2300	5.20
ACCEL TO 100%		0					
TAKE OFF 100%		7-	1359	124	117	2500	1.20
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-/-	-/-	-/-	-0-	-0-	-0-
CLIMB-LEAN		-/-	1026	79.5	1070	1000	6.80
PATTERN		-/-	463.5	39.0	65	1300	4.40
IDLE-TAXI		-/-	126	13.8	35	6000	6.15
SHUTDOWN		0					
HOT START		0	85.5	10.8	48	22500	5.90

ENGINE MODEL 0-470-R
ENGINE S/N 211317
TEST NUMBER 33 - 4 - 1 (a, b, c)
Full Rich
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-2-71
TESTED BY Marshall Fuller Hartman
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-7
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-7
RESULTS REVISED BY: ______ DATE: ______

REL. HUM. CORR. FACTOR WRH: 1.02%
CORRECTED BAROMETER: 24.07 "HG
SPECIFIC HUMIDITY: 72 grains/# DRY AIR
NOTE: QUESTIONABLE BHP LEVELS
UNTRUSTED TORQUE METER

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-F/A	NO$_2$ gm/HR	NO$_2$ gm/# FUEL	NO$_2$ gm/BHP-HR	HC$_T$ gm/HR	HC$_T$ gm/# FUEL	HC$_T$ gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	97.3	7.2	.707	2.76	.234		390	33.1		2188	185	
	190SEC												
IDLE-TAXI-LOW		115.5	8.6	,754	3.39	,283	—	525	43.8	—	2926	243	—
IDLE-TAXI-HIGH		159.2	9.4	,774	3.94	,259	—	317	20.8	—	4470	294	—
RUN-UP		373.5	10.8	,804	24.5	,778	—	213	6.7	—	7382	234	—
ACCEL TO 100%													
TAKE OFF 100%		1483	10.9	,806	108	.875	—	1913	15.4	—	52510	463	—
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		1105	12.9	.835	738	9.28	—	204	3.3	—	88519	358	—
PATTERN		502.5	11.8	,824	20.4	.523	—	159	4.0	—	8409	215	—
IDLE-TAXI		139.8	9.1	.767	3.02	,218	—	215	15.6	—	3228	233	—
SHUTDOWN													
HOT START		96.3	7.9	,732	2.79	.258		571	52.9		2086	193	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211317
TEST NUMBER 34 : 4 : 2
(a) (b) (c)
Full Rich
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-7-71
TESTED BY Marshall Fuller Hartman
COMPUTER DATA PREPARED BY: Pequeiro DATE: 7-7
COMPUTER DATA PROCESSED BY: Pequeiro DATE: 7-7
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.91 "HG
SPECIFIC HUMIDITY: 80 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.13%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	85.5	12.4	65	15000	8.50
	190SEC	0					
IDLE-TAXI-LOW		2.1	99.0	12.7	63	10000	8.80
IDLE-TAXI-HIGH		7.0	144.0	14.9	75	5500	8.25
RUN-UP		36.6	351.0	32.5	137	2300	6.45
ACCEL TO 100%		0					
TAKE OFF 100%		199.7	1341.0	125	108	2400	10.90
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		161.7	1044	83	750	1000	4.90
PATTERN		58.4	450	40	195	1600	5.95
IDLE-TAXI		6.5	126	14.4	65	6500	7.90
SHUTDOWN		0					
HOT START		0	72	9.4	85	27500	7.20

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-δF/A	NO_2			HC_T			CO		
					gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	97.9	6.8	.692	3.7	.299		396	31.9		2953	238	
	190SEC												
IDLE-TAXI-LOW		111.7	7.7	.728	4.23	.333	2.01	295	23.2	140	3597	283	1713
IDLE-TAXI-HIGH		158.9	9.6	.780	7.40	.496	1.05	222	14.9	31.7	4950	332	707
RUN-UP		383.5	10.8	.803	32.8	1.01	.897	219	6.7	5.9	9400	289	256
ACCEL TO 100%													
TAKE OFF 100%		1466	10.7	.802	98.9	.791	.495	876	7.0	4.3	60715	485	304
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		1127	12.5	.831	528	6.3	3.2	270	3.2	1.6	20973	252	129
PATTERN		490	11.2	.811	59.7	1.49	1.02	193	4.8	3.3	11089	277	189
IDLE-TAXI		140.4	8.75	.757	5.60	.389	.862	236	16.4	36.4	4142	287	637
SHUTDOWN													
HOT START		81.4	7.6	.723	4.14	.441		594	63		2137	227	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 0-470-R
ENGINE S/N 211317
TEST NUMBER 35 - 4 - 3
a b c
BEST POWER
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-7-71
TESTED BY Fuller - Marshall - Hartman
COMPUTER DATA PREPARED BY: Legueiru DATE: 7-7
COMPUTER DATA PROCESSED BY: Legueiru DATE: 7-7
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.91 "HG
SPECIFIC HUMIDITY: 80 grains/# DRY AIR
RELATIVE HUM. CORR. FACTOR WRH: 1.13%

→ ORDER OF ENTERING DATA →

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO%
10SEC	0					
70SEC	0					
130SEC	0	72.0	9.5	60	20000	6.70
190SEC	0					7
IDLE-TAXI-LOW	2.6	81.0	10.5	60	11000	6.95
IDLE-TAXI-HIGH	6.6	126.0	15.0	55	7000	7.40
RUN-UP	35.5	324.0	26.0	155	1600	3.30
ACCEL TO 100%	0					
TAKE OFF 100%	201.9	1341.0	125.0	108	3000	10.90
TAKE OFF TO CLIMB	0					
CLIMB-RICH	-/-	-/-	-/-	-0-	-0-	-0-
CLIMB-LEAN	162.0	1057.5	77	150	1000	2.75
PATTERN	58.8	450.0	40.5	175	1500	6.00
IDLE-TAXI	7.0	126	13.3	60	6500	7.70
SHUTDOWN	0					
HOT START	0	72	8.5	75	26500	6.80

→ ORDER OF READING RESULTS →

MODE	A+F	A/F	1-δF/A	NO_2			HC_T			CO		
				gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
10SEC												
70SEC												
130SEC	81	7.5	.720	2.9	.307		433	45		1986	209	
190SEC												
IDLE-TAXI-LOW	91	7.7	.725	3.2	.314	1.2	266	25	102	2322	221	893
IDLE-TAXI-HIGH	141	8.4	.747	4.7	.315	.717	257	17	39	3872	258	586
RUN-UP	350	12	.829	33	1.3	.954	134	5.1	3.8	4388	168	123
ACCEL TO 100%												
TAKE OFF 100%	1466	10	.802	98	.791	.490	1096	8.7	5.4	60715	485	300
TAKE OFF TO CLIMB												
CLIMB-RICH	—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN	1134	13	.845	810	10	5.0	266	3.4	1.6	11791	153	72
PATTERN	490	11	.809	53	1.3	.913	181	4.4	3.0	11192	276	190
IDLE-TAXI	139	9.4	.776	5.18	.389	.740	231	17	33	4043	303	577
SHUTDOWN												
HOT START	80	8.4	.749	3.6	.434		556	65		2034	239	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	225	27	55	15000	10.4
	190SEC	0					
IDLE-TAXI-LOW		-1-	135	13.5	10	12500	7.50
IDLE-TAXI-HIGH		-1-	225	22	45	22500	10.25
RUN-UP		-1-	522	59	45	20000	12.50
ACCEL TO 100%		0					
TAKE OFF 100%		361	2421	258	75	1800	12.50
TAKE OFF TO CLIMB		0					
CLIMB-RICH		257.5	1674	161	140	1300	10.75
CLIMB-LEAN		262.4	1692	133.5	875	900	5.25
PATTERN		177.2	1152	104.5	237	1200	2.40
IDLE-TAXI		11.5	221	23	65	17500	10.6
SHUTDOWN		0					
HOT START		0	144	9.5	10	12500	6.60

ENGINE MODEL GTS20-520-H
ENGINE S/N 188284
TEST NUMBER $\underset{a}{36}$ - $\underset{b}{1}$ - $\underset{c}{1}$

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-7-71
TESTED BY FULLER - MARSHALL - HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-8
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-8
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.91 "HG
SPECIFIC HUMIDITY: 84 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.16%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-f/A	NO$_2$ gm/HR	NO$_2$ gm/# FUEL	NO$_2$ gm/BHP-HR	HC$_T$ gm/HR	HC$_T$ gm/# FUEL	HC$_T$ gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	252	8.3	.745	8.4	.312		989	36		971	35	
	190SEC												
IDLE-TAXI-LOW		148	10	.788	.924	.068	—	469	34	—	4216	312	—
IDLE-TAXI-HIGH		247	10	.792	6.9	.315	—	1398	63	—	9598	436	—
RUN-UP		581	8.85	.760	16	.27	—	3008	57	—	27162	460	—
ACCEL TO 100%													
TAKE OFF 100%		2679	9.3	.774	124	.482	.349	1234	4.7	34	126109	488	349
TAKE OFF TO CLIMB													
CLIMB-RICH		1835	10	.796	160	.995	.622	598	3.7	2.3	74855	465	291
CLIMB-LEAN		1825	12	.832	997	7.4	3.8	394	2.9	1.5	36589	272	138
PATTERN		1256	11	.807	186	1.7	1.0	373	3.5	2.1	11466	109	64
IDLE-TAXI		244	9.6	.779	9.8	.428	.856	1088	47	94	976	42	84
SHUTDOWN													
HOT START		153	15	.860	.945	.099		437	46		3793	399	

QF.

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210206
TEST NUMBER 37 - 2 - 1
(a) (b) (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-8-71
TESTED BY Fuller - Marshall - Hartman
COMPUTER DATA PREPARED BY: Pequeiro DATE: 7-9
COMPUTER DATA PROCESSED BY: Pequeiro DATE: 7-9
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.64 "HG
SPECIFIC HUMIDITY: 110 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.54%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO%
	10 SEC	0					
	70 SEC	0					
	130 SEC	0	243	22	55	6000	7.60
	190 SEC	0					
IDLE-TAXI-LOW		5.9	144	12	35	16000	4.50
IDLE-TAXI-HIGH		16.9	243	22	40	6000	7.30
RUN-UP		57.8	540	54	62	3000	10.4
ACCEL TO 100%		0					
TAKE OFF 100%		360.7	2444	261	42	2000	12.5
TAKE OFF TO CLIMB		0					
CLIMB-RICH		271.9	1719	150	168	1000	9.50
CLIMB-LEAN		281.3	1701	133.5	1050	700	4.25
PATTERN		177.5	1148	108.5	155	1200	9.10
IDLE-TAXI		16.7	207	21	30	6000	7.50
SHUTDOWN		0					
HOT START		0	144	12.5	35	12500	4.25

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10 SEC												
	70 SEC												
	130 SEC	265	11	.808	9.1	.414		393	17		7658	348	
	190 SEC												
IDLE-TAXI-LOW		156	12	.823	3.4	.284	.578	606	50	102	2669	222	452
IDLE-TAXI-HIGH		265	11	.808	6.6	.301	.392	393	17	23	7356	334	435
RUN-UP		594	10.0	.788	23	.424	.396	457	8.3	7.8	23387	433	405
ACCEL TO 100%													
TAKE OFF 100%		2705	9.3	.773	70	.269	.195	1385	5.3	3.8	12730	48	35
TAKE OFF TO CLIMB													
CLIMB-RICH		1869	11	.815	196	1.3	.722	459	3.0	1.6	67545	450	248
CLIMB-LEAN		1834	12	.833	1202	9.0	4.2	307	2.3	1.0	29596	221	105
PATTERN		1256	10	.799	121	1.1	.685	376	3.4	2.1	43423	400	244
IDLE-TAXI		288	9.8	.784	4.2	.202	.254	346	16	20	6467	307	387
SHUTDOWN													
HOT START		156	11	.815	3.4	.274		480	38		2530	202	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210 206
TEST NUMBER $\underset{a}{38}$ - $\underset{b}{2}$ - $\underset{c}{2}$

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-8-71
TESTED BY FULLER - MARSHALL - HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-9
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-9
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.76 "HG
SPECIFIC HUMIDITY: 103 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.44%

→ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	261	23	110	6000	6.90
	190 SEC	0					
IDLE-TAXI-LOW		6.2	149	11.7	75	10 000	3.30
IDLE-TAXI-HIGH		19	261	23	65	5000	7.05
RUN-UP		59.4	553.5	44	250	1800	5.45
ACCEL TO 100%		0					
TAKE OFF 100%		362.7	2421	256	85	1500	12.10
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		271.1	1710	133.5	780	600	5.05
PATTERN		179.5	1152	94	580	900	5.45
IDLE-TAXI		17.8	207	21	65	9000	5.80
SHUTDOWN		0					
HOT START		0	144	11.8	62	12500	4.10

→ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	284	11	.813	19	.849		419	18		7454	324	
	190SEC												
IDLE-TAXI-LOW		160	12	.833	7.5	.643	1.2	385	32	62	2013	172	324
IDLE-TAXI-HIGH		284	11	.813	11	.502	.607	349	15	18	7616	331	400
RUN-UP		597	12	.831	93	2.1	1.5	258	5.8	4.3	12367	281	208
ACCEL TO 100%													
TAKE OFF 100%		2677	9.4	.775	141	.550	.388	1026	4.0	2.8	122076	476	336
TAKE OFF TO CLIMB													
CLIMB-RICH		—	—	—	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		1843	12	.834	897	6.7	3.3	264	1.9	.976	35331	264	130
PATTERN		1246	12	.827	451	4.8	2.5	271	2.8	1.5	25812	274	143
IDLE-TAXI		228	9.8	.784	9.2	.439	.517	520	24	29	5001	238	280
SHUTDOWN													
HOT START		155	12	.826	6.0	.511		471	39		2428	205	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC_T	CO%
	10 SEC	0					
	70 SEC	0					
	130 SEC	0	252	22.5	75	5000	7.10
	190 SEC	0					
IDLE-TAXI-LOW		5.8	144	12.3	50	12500	4.25
IDLE-TAXI-HIGH		17.4	261	22.5	65	6000	6.95
RUN-UP		57.5	553.5	54.5	92	2600	10.05
ACCEL TO 100%		0					
TAKE OFF 100%		350.2	2474	261	65	1800	12.50
TAKE OFF TO CLIMB		0					
CLIMB-RICH		264.1	1719	159	175	1100	9.00
CLIMB-LEAN		270.2	1710	133.5	1120	700	3.95
PATTERN		172.9	1148	107.5	165	1300	9.20
IDLE-TAXI		17.9	221	21	62	5000	7.60
SHUTDOWN		0					
HOT START		0	149	11.2	60	10000	4.25

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210 206
TEST NUMBER 39 - 2 - 3 (a, b, c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-8-71
TESTED BY FULLER - MARSHALL - HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-9
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-9
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.76 "HG
SPECIFIC HUMIDITY: 103 grains/# DRY AIR
REL. HUM. CORR. FACTOR W_{RH}: 1.44%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO_2 gm/HR	NO_2 gm/# FUEL	NO_2 gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10 SEC												
	70 SEC												
	130 SEC	274.5	11.2	.810	12.8	.572		338	15.0		7412	329	
	190 SEC												
IDLE-TAXI-LOW		756.3	11.7	.818	4.88	.397	.843	477	.38	82	2524	205	435
IDLE-TAXI-HIGH		283.5	11.6	.817	11.5	.512	.662	416	18	23	7495	333	430
RUN-UP		608	10.1	.791	34.8	.639	.606	398	7.3	6.9	23157	424	402
ACCEL TO 100%													
TAKE OFF 100%		2735	9.4	.776	110.2	.422	314	1258	4.8	3.5	128873	493	367
TAKE OFF TO CLIMB													
CLIMB-RICH		1898	10.8	.803	205.4	1.292	.777	514	3.2	1.9	64237	404	243
CLIMB-LEAN		1843	12.8	.834	1288	9.6	4.7	308	2.3	1.1	27635	607	106
PATTERN		1255	10.6	.801	1244	1.20	.748	407	3.7	2.3	43880	408	253
IDLE-TAXI		242.0	10.5	.798	9.36	.446	.523	302	14.4	16.9	6983	332	390
SHUTDOWN													
HOT START		160.2	13.3	.840	5.98	.534		379	33.9		2578	230	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210219
TEST NUMBER 40 : 3 : 1
(a) (b) (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-9-71
TESTED BY Fuller - Marshall - Hartmann
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-9
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-9
RESULTS REVISED BY: ____________ DATE: ____

CORRECTED BAROMETER: 29.00 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.17%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	256.5	25	75	3500	8.25
	190SEC	0					
IDLE-TAXI-LOW		7.0	149	13.5	65	9000	3.30
IDLE-TAXI-HIGH		19.3	234	22.5	75	4000	8.35
RUN-UP		60.7	540	58.5	85	3000	11.05
ACCEL TO 100%		0					
TAKE OFF 100%		359.7	2430	261	65	1800	12.5
TAKE OFF TO CLIMB		0					
CLIMB-RICH		296.6	1728	156	235	1100	8.80
CLIMB-LEAN		274.3	1701	133.5	1010	800	4.50
PATTERN		170.0	1152	108.5	175	1300	9.30
IDLE-TAXI		18.5	212	21.5	75	4500	8.80
SHUTDOWN		0					
HOT START		0	144	12.8	75	10.000	3.40

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	281.5	10.2	.793	13.1	.526		247	9.9		8806	352	
	190SEC												
IDLE-TAXI-LOW		162.5	11.0	.807	6.6	.489	.943	362	26.8	51.7	2039	151	291
IDLE-TAXI-HIGH		256.5	10.4	.796	12.0	.533	.062	257	11.4	1.3	8720	.360	400
RUN-UP		598.5	9.2	.770	31.4	.537	.518	461	7.8	7.5	24862	424	409
ACCEL TO 100%													
TAKE OFF 100%		2691.0	9.3	.772	108	.414	.300	1242	4.7	3.4	126572	484	351
TAKE OFF TO CLIMB													
CLIMB-RICH		1884	11.0	.808	276.9	1.77	.933	512	3.2	1.7	63047	404	212
CLIMB-LEAN		1854.5	12.7	.833	1156.8	8.66	4.2	351	2.6	1.2	31337	234	114
PATTERN		1260.5	10.6	.800	137.8	1.27	.810	409	3.7	2.4	44525	410	261
IDLE-TAXI		233.5	9.8	.785	10.8	.506	.588	266	12.13	14.4	2971	361	420
SHUTDOWN													
HOT START		156.8	11.2	.811	7.3	.574		386	30.2		2027	158	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	243	24	62	5000	8.25
	190SEC	0					
IDLE-TAXI-LOW		5.7	153	13.1	62	15050	1.30
IDLE-TAXI-HIGH		19.2	238.5	22	75	3500	8.05
RUN-UP		62.4	567	45	230	1800	5.55
ACCEL TO 100%		0					
TAKE OFF 100%		359.4	2412	256	75	1500	12.5
TAKE OFF TO CLIMB		0					
CLIMB-RICH		-1-	-1-	-1-	-0-	-0-	-0-
CLIMB-LEAN		270.6	1697	133.5	925	700	4.55
PATTERN		178.4	1152	90	945	900	4.25
IDLE-TAXI		18.4	225	19.5	87	2500	6.35
SHUTDOWN		0					
HOT START		0	149	12.2	67	12500	2.50

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210 219
TEST NUMBER 41 - 3 - 2
a b c
EXHAUST SAMPLE TAKEN DOWNSTREAM OF WASTE GATE
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 8-9-71
TESTED BY FULLER-MARSHALL-HARTMAN
COMPUTER DATA PREPARED BY: REGUEIRO DATE: 7-12
COMPUTER DATA PROCESSED BY: REGUEIRO DATE: 7-12
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 29.00 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.17%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	267.0	10.1	.790	10.3	.429		336	14.0		8346	347	
	190SEC												
IDLE-TAXI-LOW		166.1	11.6	.818	6.4	.491	1.13	611	46	107	821	62.7	144
IDLE-TAXI-HIGH		260.5	10.8	.804	12.2	.555	.636	226	10.3	11.8	7970	362	415
RUN-UP		612.0	12.6	.831	87.9	1.95	1.409	264	5.8	4.2	12899	286	206
ACCEL TO 100%													
TAKE OFF 100%		2668	9.4	.774	123.9	.484	.344	1023	3.9	2.8	125642	490	349
TAKE OFF TO CLIMB													
CLIMB-RICH		2.0	1.0	1.1	—	—	—	—	—	—	—	—	—
CLIMB-LEAN		1830.5	12.7	.833	1057	7.9	3.9	307	2.3	1.13	31419	236	116
PATTERN		1242	12.8	.834	732	8.1	4.1	267	2.9	1.5	20033	222	112
IDLE-TAXI		244.5	11.5	.816	13.3	.682	.723	149	7.6	8.1	5900	302	321
SHUTDOWN													
HOT START		161.2	12.2	.826	6.7	.553		487	39.9		1532	125	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO
	10 SEC	0					
	70 SEC	0					
	130 SEC	0	85.5	10.6	90	47500	8.05
	190 SEC	0					
IDLE-TAXI-LOW		2.6	94.5	11.0	75	35000	8.65
IDLE-TAXI-HIGH		7.2	135.0	14.5	67	11500	9.10
RUN-UP		35.6	324	32.0	108	2800	8.60
ACCEL TO 100%		0					
TAKE OFF 100%		208.6	1350	133.0	90	3300	12.00
TAKE OFF TO CLIMB		0					
CLIMB-RICH		165.5	1066.5	88	435	1600	6.70
CLIMB-LEAN		166.3	1071	86.5	425	1300	7.10
PATTERN		57.0	441	38	140	3400	7.75
IDLE-TAXI		7.4	130.5	13.7	67	10000	9.20
SHUTDOWN		0					
HOT START		0	76.5	9.4	115	50000	7.60

ENGINE MODEL 0-470-R
ENGINE S/N 211333
TEST NUMBER $\underset{a}{42}$ - $\underset{b}{5}$ - $\underset{c}{1}$
Full Rich
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-9-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-12
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-12
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 29.07 "HG
SPECIFIC HUMIDITY: 70 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .97%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10 SEC												
	70 SEC												
	130 SEC	96.1	8.0	.737	5.24	.494		1201	113		2850	268	
	190 SEC												
IDLE-TAXI-LOW		105.5	8.5	.753	4.8	.440	1.86	960	87.3	369	3398	308	1307.
IDLE-TAXI-HIGH		149.5	9.3	.772	6.1	.427	.860	440	30.4	6.2	5119	353	710
RUN-UP		356.0	10.1	.790	23.9	.748	.673	251	7.8	7.0	11600	362	325
ACCEL TO 100%													
TAKE OFF 100%		1483	10.1	.791	83.1	.625	.398	1233	9.2	5.9	67142	507	323
TAKE OFF TO CLIMB													
CLIMB-RICH		1154.5	12.1	.825	314	3.56	1.89	448	5.09	2.7	29410	334	177
CLIMB-LEAN		1157	12.3	.828	307	3.55	1.84	363	4.1	2.1	31230	361	187
PATTERN		479	11.6	.817	47.9	1.26	.841	398	10.4	6.9	14122	371	247
IDLE-TAXI		144.2	9.5	.777	5.99	.437	.809	368	26.8	49.7	5003	365	676
SHUTDOWN													
HOT START		85.9	8.1	.739	5.99	.638		1128	120		2409	256	

AIRCRAFT EMISSIONS PROGRAM

FUEL-EMISSIONS HOOKS -O-470-R ENGINE S/N 2H333

TEST NUMBER 43 - 5 - 2

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-9-71
TESTED BY: FULLER MARSHALL
COMPUTER DATA PREPARED BY: Leguerru DATE: 7-12
COMPUTER DATA PROCESSED BY: Leguerru DATE: 7-12
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 29.05 "HG
SPECIFIC HUMIDITY: 74 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.02%

ORDER OF ENTERING DATA

RPM	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (P.P.M)		%	BSFC
				NO	HCT	CO	
2595	208.3	1341	130	75	2500	12.3	.624
2595	209.0	1341	126	80	2200	11.9	.603
2598	210.7	1341	122	95	2100	11.0	.579
2597	213.4	1336.5	118	115	2100	10.0	.553
2597	213.4	1332	114	145	1600	9.7	.534
2600	214.9	1323	110	190	1500	8.6	.512
2601	215.9	1318.5	106	260	1300	7.9	.491
2587	215.7	1318.5	102	465	1300	6.4	.473
2584	214.5	1314	98	500	1200	6.3	.457
2567	212.1	1309.5	94	720	1100	5.2	.443
2555	208.5	1305	90	1140	1000	4.0	.432
2540	204.1	1296	86	1480	900	3.2	.422
2510	196.4	1278	82	2250	700	1.9	.418
2477	187.2	1269	78	3450	500	.4	.417

ORDER OF READING RESULTS

A+F	A/F	1-αF/A	NO2			HCT			CO		
			gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR
1471	10.32	.794	68.8	.529	.330	924	7.1	4.4	68631	527	329
1467	10.64	.800	73.3	.581	.350	805	6.3	3.8	66312	526	317
1463	10.99	.807	86.9	.712	.412	761	6.2	3.6	61188	501	290
1454	11.33	.812	104.6	.886	.490	752	6.3	3.5	55328	468	259
1446	11.68	.818	131.1	1.15	.614	565	4.9	2.6	53357	468	250
1433	12.03	.823	170.2	1.54	.792	522	4.7	2.4	46865	426	218
1424	12.44	.829	231	2.18	1.07	446	4.2	2.06	42758	403	198
1420	12.93	.835	412	4.04	1.9	441	4.3	2.04	34487	338	169
1412	13.41	.841	439	4.4	2.04	401	4.0	1.8	33675	343	156
1403	13.93	.847	627	6.6	2.9	361	3.8	1.7	27552	293	129
1395	14.50	.853	983	10.9	4.7	323	3.5	1.5	20991	233	100.
1382	15.07	.859	1264.4	14.7	6.1	286	3.3	1.4	16621	193	81.4
1360	15.59	.863	1901.8	23.1	9.6	219	2.6	1.1	9764	119	44.
1347	16.27	.869	2907	37.2	15.5	155	1.9	.828	2049	26.2	10.9

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 10-520-D
ENGINE S/N 159987
TEST NUMBER 44 - 5 - 1 (a - b - c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-12-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: REQUEIRO DATE: 7-13
COMPUTER DATA PROCESSED BY: REQUEIRO DATE: 7-13
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.83 "HG
SPECIFIC HUMIDITY: 82 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.14%

→ORDER OF ENTERING DATA→

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC_T	CO%
10SEC	0					
70SEC	0					
130SEC	0	95.5	9.6	70	32500	2.25
190SEC	0					
IDLE-TAXI-LOW	1.1	99	11.2	70	35000	2.25
IDLE-TAXI-HIGH	5.8	130.5	15.2	85	27500	4.30
RUN-UP	33.0	328.5	36.5	60	6500	10.40
ACCEL TO 100%	0					
TAKE OFF 100%	268.0	1597.5	154	180	2400	9.25
TAKE OFF TO CLIMB	0					
CLIMB-RICH	207.1	1224	119	180	2100	9.75
CLIMB-LEAN	210.2	1210.5	92	2200	1400	2.20
PATTERN	54.3	436.5	49	76	6000	11.30
IDLE-TAXI	5.6	121.5	14.3	95	27500	4.30
SHUTDOWN	0					
HOT START	0	58.5	8.5	110	50000	1.75

→ORDER OF READING RESULTS→

MODE	A+F	A/F	$1-\alpha F/A$	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HC_T gm/HR	HC_T gm/# FUEL	HC_T gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
10SEC												
70SEC												
130SEC	95.1	8.9	.761	4.09	.426		799	93.2		800	83.4	
190SEC												
IDLE-TAXI-LOW	110.2	8.8	.760	4.74	.423	4.31	998	89	907	927	82.7	842
IDLE-TAXI-HIGH	145.7	8.5	.753	7.58	.499	1,30	1042	68	179	2333	153	402
RUN-UP	365	9.0	.764	13.5	.369	.409	412	16.7	18.5	14228	389	431
ACCEL TO 100%												
TAKE OFF 100%	1751.5	10.3	.795	196.7	1.27	.734	1055	6.8	3.9	64795	420	241
TAKE OFF TO CLIMB												
CLIMB-RICH	1343	10.2	.793	150.7	1.26	.728	709	5.9	3.4	49661	417	239
CLIMB-LEAN	1302	13.1	.838	1786	19.4	8.4	423	4.7	2.06	10860	118	51
PATTERN	485.5	8.9	.762	22.4	.457	.412	753	15.3	13.8	20537	419	378
IDLE-TAXI	135.8	8.4	.750	7.88	.551	1.40	973	68	173	2171	151	387
SHUTDOWN												
HOT START	67.3	6.8	.693	432	.508		907	106		418	49.2	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC$_T$	CO%
	10sec	0					
	70sec	0					
	130sec	0	90	9.8	50	14000	2.70
	190sec	0					
IDLE-TAXI-LOW		2.7	94.5	9.9	60	17500	2.60
IDLE-TAXI-HIGH		6.8	130.5	13.4	65	15000	3.00
RUN-UP		33.2	306.0	30	150	2500	5.20
ACCEL TO 100%		0					
TAKE OFF 100%		269.3	1683	155	175	2300	9.65
TAKE OFF TO CLIMB		0					
CLIMB-RICH		211.3	1264.5	122	175	2800	9.50
CLIMB-LEAN		217.8	1242	95	1625	2100	3.15
PATTERN		55.7	436.5	48.5	85	5500	11.00
IDLE-TAXI		4.6	121.5	13.5	90	42500	3.65
SHUTDOWN		0					
HOT START		0	67.5	7.8	90	50000	2.05

ENGINE MODEL 10-520-D
ENGINE S/N 159 987
TEST NUMBER 45 - 5 - 2
(a) (b) (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-13-71
TESTED BY FULLER - MARSHALL - HARTMAN
COMPUTER DATA PREPARED BY: REGUERO DATE: 7-13
COMPUTER DATA PROCESSED BY: REGUEIRO DATE: 7-13
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.52 "HG
SPECIFIC HUMIDITY: 99 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.40%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-αF/A	NO$_2$			HC$_T$			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10sec												
	70sec												
	130sec	99.8	9.183	0.769	3.083	0.314		359.2	36.6		1012.4	103.3	
	190sec												
IDLE-TAXI-LOW		104.4	7.5	0.777	3.886	0.372	1.437	466.2	47.09	172.6	1023.8	103.4	579.2
IDLE-TAXI-HIGH		143.9	9.73	0.782	5.813	0.433	.854	548.7	40.9	80.6	1631.2	121.7	239.8
RUN-UP		336.	10.2	.792	31.4	1.04	.946	211.5	7.05	6.3	6623.3	220.7	199.4
ACCEL TO 100%													
TAKE OFF 100%		1838	10.8	.809	201.08	1.297	.746	1050.8	6.7	3.9	67417.9	434.9	250.3
TAKE OFF TO CLIMB													
CLIMB-RICH		1386.5	10.3	.795	151.4	1.241	.716	974.5	7.9	4.6	49975	409	236
CLIMB-LEAN		1337	13.0	.837	1354	14.2	6.2	668	7.0	3.0	15967	168	73
PATTERN		485	9.0	.764	25.4	.524	.456	688	14.1	12.3	19997	412	359
IDLE-TAXI		135	9.0	.764	7.4	.554	1.134	1480	109	224	1846	136	279
SHUTDOWN													
HOT START		75.3	8.6	.755	4.1	.532		978	125		575	73.7	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL 10-520-D
ENGINE S/N 159987
TEST NUMBER 46 (a) - 5 (b) - 3 (c)

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-13-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: Requi RO DATE: 7-13
COMPUTER DATA PROCESSED BY: Requi RO DATE: 7-13
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.52 "HG
SPECIFIC HUMIDITY: 99 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.40%

→ORDER OF ENTERING DATA→

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	85.5	10.1	85	40000	1.65
	190SEC	0					
IDLE-TAXI-LOW		3.1	99	10.8	85	27500	1.65
IDLE-TAXI-HIGH		7.9	144	15.2	205	22500	2.65
RUN-UP		34.8	346.5	37	95	7500	8.75
ACCEL TO 100%		0					
TAKE OFF 100%		271.9	1611	155	180	2300	9.50
TAKE OFF TO CLIMB		0					
CLIMB-RICH		212.4	1251	120	185	2500	9.50
CLIMB-LEAN		218.1	1242	92	1700	2000	3.15
PATTERN		56.8	463.5	50.5	80	6500	11.20
IDLE-TAXI		7.0	126.0	13.8	100	35000	3.60
SHUTDOWN		0					
HOT START		0	74.3	8.5	90	50000	1.60

→ORDER OF READING RESULTS→

MODE		A+F	A/F	1-kF/A	NO2 gm/HR	NO2 gm/# FUEL	NO2 gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	95.6	8.4	.749	4.9	.491		997	98.7		586	58	
	190SEC												
IDLE-TAXI-LOW		109	9.1	.768	5.7	.533	1.8	776	71.9	250	680	63	219
IDLE-TAXI-HIGH		159	9.4	.776	20.2	1.3	2.5	915	60	115	1590	104	201
RUN-UP		383	9.3	.773	22.5	.609	.648	736	19.9	21	14078	380	404
ACCEL TO 100%													
TAKE OFF 100%		1766	10.4	.796	189	1.2	.729	1019	6.5	3.7	63663	410	234
TAKE OFF TO CLIMB													
CLIMB-RICH		1371	10.4	.796	185	1.3	.745	859	7.1	4.0	49430	411	232
CLIMB-LEAN		1334	13.5	.842	1411	15.3	6.4	630	6.8	2.8	15900	172	72
PATTERN		514	9.1	.769	25.4	.503	.447	859	17	15	21628	428	380
IDLE-TAXI		139.8	9.13	.767	8.6	.63	1.23	1259	91	180	1890	137	270
SHUTDOWN													
HOT START		82.8	8.7	.757	4.5	.538		1074	126		494	58	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210221
TEST NUMBER 47 - 4 - 1
(a) (b) (c)
FULL RICH

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-14-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-17
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-19
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.83 "HG
SPECIFIC HUMIDITY: 73 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.05%

→ ORDER OF ENTERING DATA →

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC_T	CO%
10 SEC	0					
70 SEC	0					
130 SEC	0	256.5	25	62	5000	9.75
190 SEC	0					
IDLE-TAXI-LOW	7.6	153	14	65	7500	6.80
IDLE-TAXI-HIGH	19.4	234	22.5	65	3500	3.30
RUN-UP	63.4	571.5	55.5	98	2700	10.15
ACCEL TO 100%	0					
TAKE OFF 100%	364.5	2412	254	80	1800	8.50
TAKE OFF TO CLIMB	0					
CLIMB-RICH	262.7	1674	164	145	1300	9.90
CLIMB-LEAN	276.5	1701	133.5	600	800	3.35
PATTERN	173.9	1147.5	109.5	165	1400	9.10
IDLE-TAXI	19.4	225	23.5	50	6000	9.75
SHUTDOWN	0					
HOT START	0	144	14	62	10500	5.90

→ ORDER OF READING RESULTS →

MODE	A+F	A/F	1-αF/A	NO_2			HC_T			CO		
				gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR	gm/HR	gm/#FUEL	gm/BHP-HR
10 SEC												
70 SEC												
130 SEC	281.5	10.2	.793	10.8	.435		354	14.1		10407	416	
190 SEC												
IDLE-TAXI-LOW	167.0	10.9	.806	6.78	.484	.893	310	22.2	40	4317	308	568
IDLE-TAXI-HIGH	256.5	10.4	.796	10.4	.462	.536	225	10.0	11.6	3212	142	165
RUN-UP	627.0	10.2	.794	38.3	.690	.604	425	7.6	6.7	24137	434	380
ACCEL TO 100%												
TAKE OFF 100%	2675	9.5	.777	132	.522	.364	1229	4.8	3.3	85756	337	235
TAKE OFF TO CLIMB												
CLIMB-RICH	1838	10.2	.792	166	1.01	.632	601.7	3.6	2.2	68881	420	262
CLIMB-LEAN	1834	12.7	.833	687	5.14	2.48	351.	2.6	1.2	23328	174	84.3
PATTERN	1257	10.4	.797	129	1.18	.744	440	4.0	2.5	43422	396	249
IDLE-TAXI	248.5	9.5	.778	7.71	.328	.397	380	16.1	19.6	9141	389	471
SHUTDOWN												
HOT START	158	10.2	.793	6.11	.436		417	24.7		3535	252	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210221
TEST NUMBER 48 : 4 : 2
(a) (b) (c)
FULL RICH
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-14-71
TESTED BY FULLER MARSHALL HARTMAN
COMPUTER DATA PREPARED BY: [illegible] DATE: 7-17
COMPUTER DATA PROCESSED BY: [illegible] DATE: 7-17
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.84 "HG
SPECIFIC HUMIDITY: 76 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.07%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	252	25.5	55	5700	9.65
	190SEC	0					
IDLE-TAXI-LOW		6.8	157.5	14.2	50	9000	6.25
IDLE-TAXI-HIGH		18.5	261	25.0	60	3500	3.30
RUN-UP		60.6	553.5	55.5	100	2600	10.15
ACCEL TO 100%		0					
TAKE OFF 100%		366.2	2475	254	75	1800	12.12
TAKE OFF TO CLIMB		0					
CLIMB-RICH		265.2	1701	161	140	1200	9.90
CLIMB-LEAN		275.2	1701	134	925	600	4.50
PATTERN		169.7	1134	107.5	158	1200	9.30
IDLE-TAXI		18.7	211.5	23.5	50	5500	9.25
SHUTDOWN		0					
HOT START		0	153	14.3	62	10000	6.35

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-F/A	NO₂			HC_T			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	277	9.8	.785	9.4	.372		400	15.7		10130	397	
	190SEC												
IDLE-TAXI-LOW		171	11.0	.808	5.3	.378	.789	382	26.9	56.2	4080	287	600
IDLE-TAXI-HIGH		286	10	.796	10	.428	.579	250	10	13.5	3582	143	193
RUN-UP		209	9.9	.787	37	.683	.625	400	7.2	6.6	23398	421	386
ACCEL TO 100%													
TAKE OFF 100%		2729	9.7	.782	127	0.50	.347	1248	4.9	3.4	125810	495	343
TAKE OFF TO CLIMB													
CLIMB-RICH		1862	10.5	.799	162	1.0	.613	558	3.4	2.1	70001	434	263
CLIMB-LEAN		1835	12.2	.832	1059	7.9	3.8	264	1.9	.959	31350	233	113
PATTERN		1241	10.5	.799	122	1.1	.721	372	3.4	2.1	43842	407	258
IDLE-TAXI		235	9.0	.764	7.2	.308	.387	333	14	77	8588	365	459
SHUTDOWN													
HOT START		167	10	.801	6.4	.453		417	29		4036	282	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210221
TEST NUMBER 49 : 4 : 3
(a : b : c)
BEST POWER
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-14-71
TESTED BY FULLER - MARSHALL - HARTMAN
COMPUTER DATA PREPARED BY: LEGUERRO DATE: 7-17
COMPUTER DATA PROCESSED BY: LEGUERRO DATE: 7-17
RESULTS REVISED BY: ______ DATE: ______

CORRECTED BAROMETER: 28.84 "HG
SPECIFIC HUMIDITY: 75 grains/# DRY AIR
REL. HUM. CORR. FACTOR W_{RH}: 1.05%

→ ORDER OF ENTERING DATA →

MODE	BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC_T	CO%
10SEC	0					
70SEC	0					
130SEC	0	252	22	80	3300	8.25
190SEC	0					
IDLE-TAXI-LOW	6.6	153	13.3	65	2500	5.60
IDLE-TAXI-HIGH	19.1	238.5	21.0	85	3000	7.70
RUN-UP	59.8	522	45	165	1800	6.95
ACCEL TO 100%	0					
TAKE OFF 100%	362.7	2421	254	98	1600	12.2
TAKE OFF TO CLIMB	0					
CLIMB-RICH	264.2	1687.5	160	175	1200	9.80
CLIMB-LEAN	270.9	1674	133.5	925	700	4.55
PATTERN	175.5	1129.5	89	1050	900	3.70
IDLE-TAXI	18.1	220.5	21	75	4500	8.15
SHUTDOWN	0					
HOT START	0	144	13.2	80	12500	5.70

→ ORDER OF READING RESULTS →

MODE	A+F	A/F	1-F/A	NO_2			HC_T			CO		
				gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
10SEC												
70SEC												
130SEC	274.0	11.4	.814	13.7	.623		222	10.0		8599	390	
190SEC												
IDLE-TAXI-LOW	166.3	11.5	.815	6.76	.508	1.029	306	23	46	3542	266	536
IDLE-TAXI-HIGH	259.5	11.3	.813	13.8	.657	.722	191	9.12	10.0	7601	361	397
RUN-UP	567.0	11.6	.817	58.5	1.30	.978	250	5.5	4.1	14991	333	250
ACCEL TO 100%												
TAKE OFF 100%	2675.0	9.5	.777	162.6	.640	.448	1092	4.3	3.0	123085	484	339
TAKE OFF TO CLIMB												
CLIMB-RICH	1847.5	10.5	.798	201.9	1.26	.764	554	3.4	2.09	68749	429	260
CLIMB-LEAN	1807.5	12.5	.830	1044	7.82	3.85	304	2.2	1.1	31239	234	115
PATTERN	1218	12.6	.832	798	8.97	4.5	263	2.9	1.4	17117	192	97.5
IDLE-TAXI	241.5	10.5	.798	11.3	.538	.624	272	12.9	15	7472	355	412
SHUTDOWN												
HOT START	157.2	10.9	.805	7.8	.595		487	36.9		3406	258	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210221
TEST NUMBER 50 (a) - 4 (b) - 4 (c)
FULL RICH
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-14-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-17
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-17
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.86 "HG
SPECIFIC HUMIDITY: 69 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: .97%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HC$_T$	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	256.5	24.0	130	3100	9.20
	190SEC	0					
IDLE-TAXI-LOW		6.1	144	14.1	45	10,000	6.25
IDLE-TAXI-HIGH		18.5	234	22	50	3700	8.15
RUN-UP		62.3	553.4	56	90	2600	10.25
ACCEL TO 100%		0					
TAKE OFF 100%		359	2430	241	90	1700	12.00
TAKE OFF TO CLIMB		0					
CLIMB-RICH		264	1710	159	160	1200	9.90
CLIMB-LEAN		267.6	1692	133.5	750	700	5.20
PATTERN		169.7	1147.5	105.5	175	1300	9.30
IDLE-TAXI		18.5	225	23.2	50	2500	10.15
SHUTDOWN		0					
HOT START		0	144	15.0	65	14000	6.10

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	1-α F/A	NO$_2$			HC$_T$			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	289.5	11.0	.808	23.5	.980		222	9.2		10128	422	
	190SEC												
IDLE-TAXI-LOW		158.1	10.2	.792	4.43	.314	.727	398	28.2	65.2	3746	265	614
IDLE-TAXI-HIGH		256.0	10.6	.800	7.99	.363	.432	236	10.7	12.7	7925	360	428
RUN-UP		609.4	9.8	.785	34.1	.609	.547	401	7.17	6.4	23629	421	379
ACCEL TO 100%													
TAKE OFF 100%		2671	10.0	.789	149.7	.621	.417	1146	4.7	3.19	121418	503	338
TAKE OFF TO CLIMB													
CLIMB-RICH		1869	10.7	.802	186.8	1.17	.707	558	3.5	2.1	70310	442	264
CLIMB-LEAN		1825.5	12.6	.832	855.0	6.40	3.19	306	2.2	1.1	36042	269	134
PATTERN		1253	10.8	.805	137.0	1.29	.807	404	3.8	2.3	44245	419	261
IDLE-TAXI		248.2	9.6	.781	7.70	.332	.416	473	20.4	25	9515	410	514
SHUTDOWN													
HOT START		159.0	9.6	.779	6.41	.427		567	37.8		3660	244	

AIRCRAFT EMISSIONS PROGRAM

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	CONCENT. (PPM) HCT	CO %
	10SEC	0					
	70SEC	0					
	130SEC	0	261	25	60	3400	9.00
	190SEC	0					
IDLE-TAXI-LOW		6.8	148.5	14.5	50	13000	6.90
IDLE-TAXI-HIGH		17.9	243	24	50	5000	9.20
RUN-UP		58.1	562.5	56.5	65	3100	10.50
ACCEL TO 100%		0					
TAKE OFF 100%		351.9	2443.5	259	55	1800	12.30
TAKE OFF TO CLIMB		0					
CLIMB-RICH		264.7	1719	160	155	1100	9.30
CLIMB-LEAN		269.8	1701	133.5	820	800	4.55
PATTERN		170.7	1152	106.5	185	1400	7.95
IDLE-TAXI		17.5	234	23	40	8000	9.30
SHUTDOWN		0					
HOT START		0	148.5	14.3	55	17000	7.10

ENGINE MODEL GTSIO-520-H
ENGINE S/N 210212
TEST NUMBER 51 (a) - 5 (b) - 1 (c)
FULL RICH
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-15-71
TESTED BY Fuller - Marshall - Hartman
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-17
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-17
RESULTS REVISED BY: ________ DATE: ____

CORRECTED BAROMETER: 28.63 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM CORR. FACTOR WRH: 1.18%

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-F/A	NO₂ gm/HR	NO₂ gm/# FUEL	NO₂ gm/BHP-HR	HCT gm/HR	HCT gm/# FUEL	HCT gm/BHP-HR	CO gm/HR	CO gm/# FUEL	CO gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	286.0	10.4	.796	10.7	.428		243	9.7		9769	390	
	190SEC												
IDLE-TAXI-LOW		163.0	10.2	.792	5.08	.350	.747	533	36.7	78	4264	294	627
IDLE-TAXI-HIGH		267.0	10.1	.790	8.31	.346	.469	336	14.0	18	9307	387	579
RUN-UP		619.0	9.9	.787	25.0	.443	.431	485	8.5	8.3	24600	435	423
ACCEL TO 100%													
TAKE OFF 100%		2702	9.4	.775	92.1	.355	.261	1244	4.8	3.5	125247	483	355
TAKE OFF TO CLIMB													
CLIMB-RICH		1879	10.7	.802	182	1.13	.687	514.9	3.2	1.9	66400	415	250
CLIMB-LEAN		1834.5	12.7	.833	939.2	7.03	3.48	351	2.6	1.3	31685	237	117
PATTERN		1258.5	10.8	.804	145.5	1.36	.852	438	4.1	2.5	38025	357	222
IDLE-TAXI		257.0	10.1	.791	6.40	.278	.366	518	22.5	24	9059	393	517
SHUTDOWN													
HOT START		162.8	10.3	.795	5.58	.390		694	48		4385	306	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTSIO- 520 -H
ENGINE S/N 210212
TEST NUMBER 52 : 5 : 2
(a) (b) (c)
BEST POWER

a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N

TEST DATE 7-15-71
TESTED BY Fuller - Marshall - Hartman
COMPUTER DATA PREPARED BY: Requeiro DATE: 7-17
COMPUTER DATA PROCESSED BY: Requeiro DATE: 7-17
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.63 "HG
SPECIFIC HUMIDITY: 83 grains/# DRY AIR
REL. HUM. CORR. FACTOR W_{RH}: 1.18%

→ ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HC_T	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	225	19.1	90	2400	5.95
	190SEC	0					
IDLE-TAXI-LOW		6.9	144	12.9	60	6000	5.40
IDLE-TAXI-HIGH		17.2	225	19.3	75	2500	6.70
RUN-UP		58.7	540	49.5	115	2000	8.35
ACCEL TO 100%		0					
TAKE OFF 100%		347.1	2421	256	62	1700	12.5
TAKE OFF TO CLIMB		0					
CLIMB-RICH		267.2	1728	159	170	1000	9.20
CLIMB-LEAN		270.8	1710	133.5	900	600	4.50
PATTERN		171.6	1125	86	1430	800	2.65
IDLE-TAXI		17.3	207	19.8	55	4500	8.50
SHUTDOWN		0					
HOT START		0	135	13.1	60	12500	5.80

→ ORDER OF READING RESULTS →

MODE		A+F	A/F	$1-\alpha F/A$	NO_2			HC_T			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	244.1	11.78	.820	13.7	.719		143	7.4		5524	289	
	190SEC												
IDLE-TAXI-LOW		156.9	11.1	.810	5.88	.456	.853	232.6	18.0	33	3222	249	467
IDLE-TAXI-HIGH		244.3	11.6	.818	11.4	.593	.666	.194	7.7	8.68	6226	322	362
RUN-UP		589.5	10.9	.805	42.3	.856	.722	242	5.9	4.9	18712	378	318
ACCEL TO 100%													
TAKE OFF 100%		2677	9.45	.775	102.8	.401	.296	1163	4.5	3.3	126180	.490	360
TAKE OFF TO CLIMB													
CLIMB-RICH		1887	10.8	.804	200.5	1.26	.750	469	2.9	1.7	65989	415	244
CLIMB-LEAN		1843	12.8	.834	1035	7.75	3.82	264	1.9	.977	31483	235	116
PATTERN		1211	13.8	.837	1079	12.5	6.24	230	2.6	1.34	12166	141	70
IDLE-TAXI		226.8	10.4	.797	7.78	.393	450	255	12.9	14.7	7317	369	422
SHUTDOWN													
HOT START		148.1	10.3	.794	5.54	.423		465	35		3258	248	

AIRCRAFT EMISSIONS PROGRAM

ENGINE MODEL GTS10-520-H
ENGINE S/N 210212
TEST NUMBER 53 - 5 - 3
FULL RICH
a: CONSECUTIVE TEST NUMBER
b: ENGINE OF THIS PARTICULAR MODEL
c: TEST ON THIS PARTICULAR ENGINE S/N
TEST DATE 7-15-71
TESTED BY Fuller Marshall Hartman
COMPUTER DATA PREPARED BY: Requeiru DATE: 7-17
COMPUTER DATA PROCESSED BY: Requeiru DATE: 7-17
RESULTS REVISED BY: ______ DATE: ____

CORRECTED BAROMETER: 28.66 "HG
SPECIFIC HUMIDITY: 79 grains/# DRY AIR
REL. HUM. CORR. FACTOR WRH: 1.12%

ORDER OF ENTERING DATA →

MODE		BHP	AIR FLOW #/HR	FUEL FLOW #/HR	CONCENT. (PPM) NO	HCT	CO%
	10SEC	0					
	70SEC	0					
	130SEC	0	243	24.5	62	7500	9.65
	190SEC	0					
IDLE-TAXI-LOW		6.9	135	13.9	60	10000	6.60
IDLE-TAXI-HIGH		17.1	243	23.0	50	6000	9.30
RUN-UP		57.5	567	57.0	65	3200	11.1
ACCEL TO 100%		0					
TAKE OFF 100%		350.2	2394	257	-0-	1700	-0-
TAKE OFF TO CLIMB		0					
CLIMB-RICH		261.7	1705.5	162	-0-	1100	-0-
CLIMB-LEAN		266.6	1696.5	133.5	-0-	600	-0-
PATTERN		167.0	1134.0	108.3	150	1300	9.00
IDLE-TAXI		16.8	229.5	24.0	45	9000	9.90
SHUTDOWN		0					
HOT START		0	148.5	13.8	60	14000	6.80

ORDER OF READING RESULTS →

MODE		A+F	A/F	1-F/A	NO2			HCT			CO		
					gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR	gm/HR	gm/# FUEL	gm/BHP-HR
	10SEC												
	70SEC												
	130SEC	267.5	9.92	.786	10.3	.42		508	21		9768	399	
	190SEC												
IDLE-TAXI-LOW		148.9	9.71	.781	5.6	.40	.80	378	27	55	3712	267	538
IDLE-TAXI-HIGH		266.0	10.6	.799	8.3	.36	.49	213	9.3	12	11212	487	656
RUN-UP		624	9.95	.786	25.2	.44	.44	505	8.9	8.9	26215	460	456
ACCEL TO 100%													
TAKE OFF 100%		2750	9.70	.781	—	—	—	1189	4.6	3.4	—	—	—
TAKE OFF TO CLIMB													
CLIMB-RICH		1867.5	10.5	.798	—	—	—	514	3.1	1.9	—	—	—
CLIMB-LEAN		1830.0	12.7	.833	—	—	—	263	1.9	.987	—	—	—
PATTERN		1242.3	10.4	.797	116.3	1.07	.696	404.	3.7	2.4	42441	391	254
IDLE-TAXI		253.5	9.5	.778	7.07	.294	.421	582	24.2	34.6	9468	394.	563
SHUTDOWN													
HOT START		162.3	10.7	.802	6.08	.441		565	41		4193	303	

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Beckman INSTRUMENTS, INC

INFRARED ANALYZER CALIBRATION CURVE

Model No 315 A
P.O DI-313-019
S.O 67948

Customer Continental Motor Corp.
Location Muskegon, Michigan
Application Nitric Oxide
Amplifier No. 200858
Zero Gas Nitrogen
Upscale Gas See Manual
Tag

Range 0–1000 PPM by Volume
Detector No. 5159 A
Calibration Pressure Atmospheric
Cylinder No.
Calibration Pressure Atmospheric
Cylinder No.
Stream Pressure

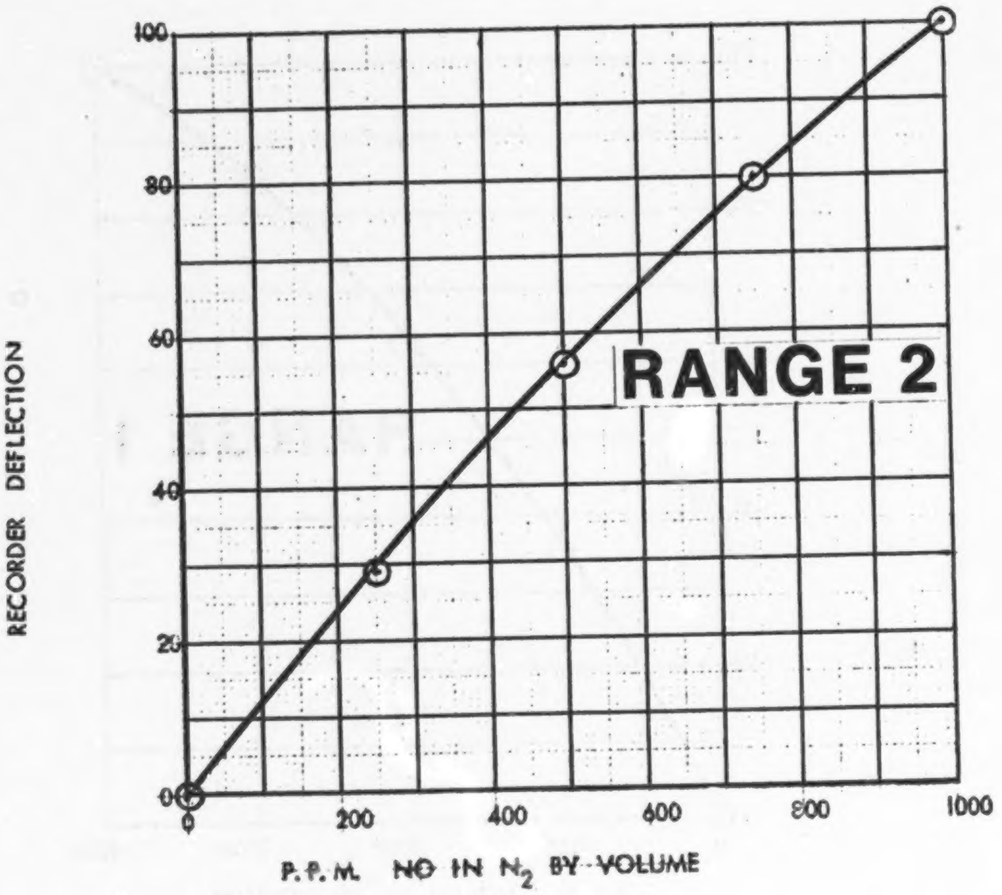


Figure B-1

Beckman INSTRUMENTS, INC.

INFRARED ANALYZER CALIBRATION CURVE

Model No 315 A
P.O. DI-313-019
S.O. 67948

Customer	Continental Motor Corp.			
Location	Muskegon, Michigan			
Application	Nitric Oxide	Range	0-4000 PPM by Volume	
Amplifier No.	200858	Detector No.	5159 A	
Zero Gas	Nitrogen	Calibration Pressure	Atmospheric	Cylinder No
Upscale Gas	See Manual	Calibration Pressure	Atmospheric	Cylinder No
Tag		Stream Pressure		

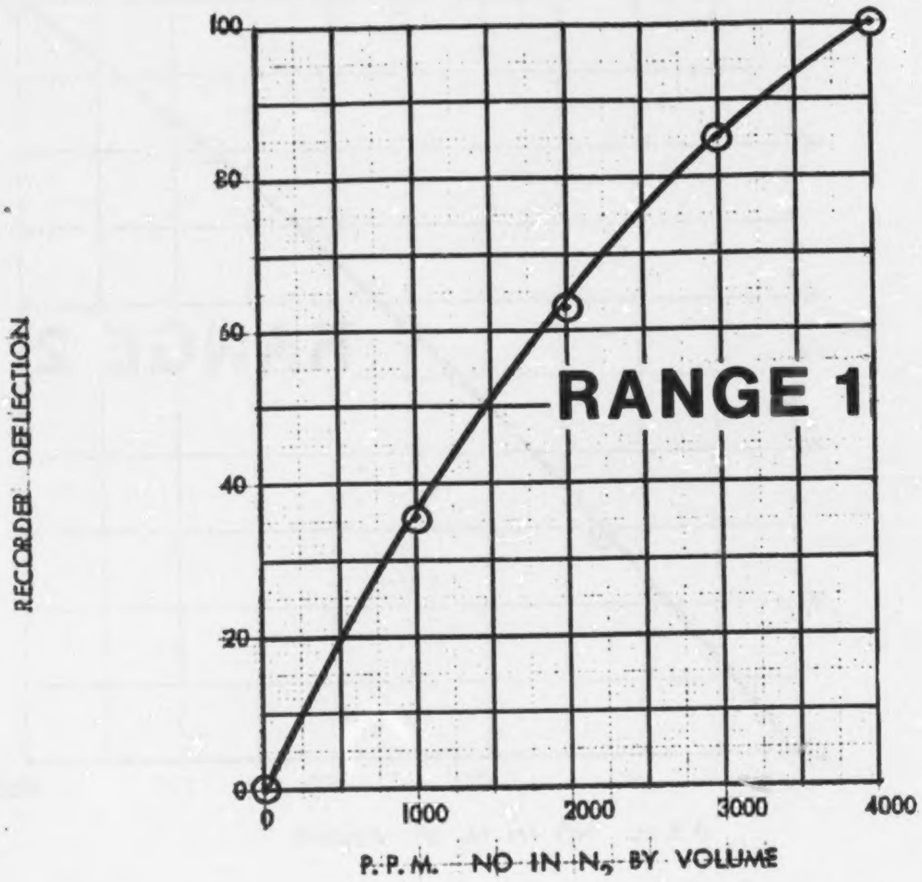


Figure B-2

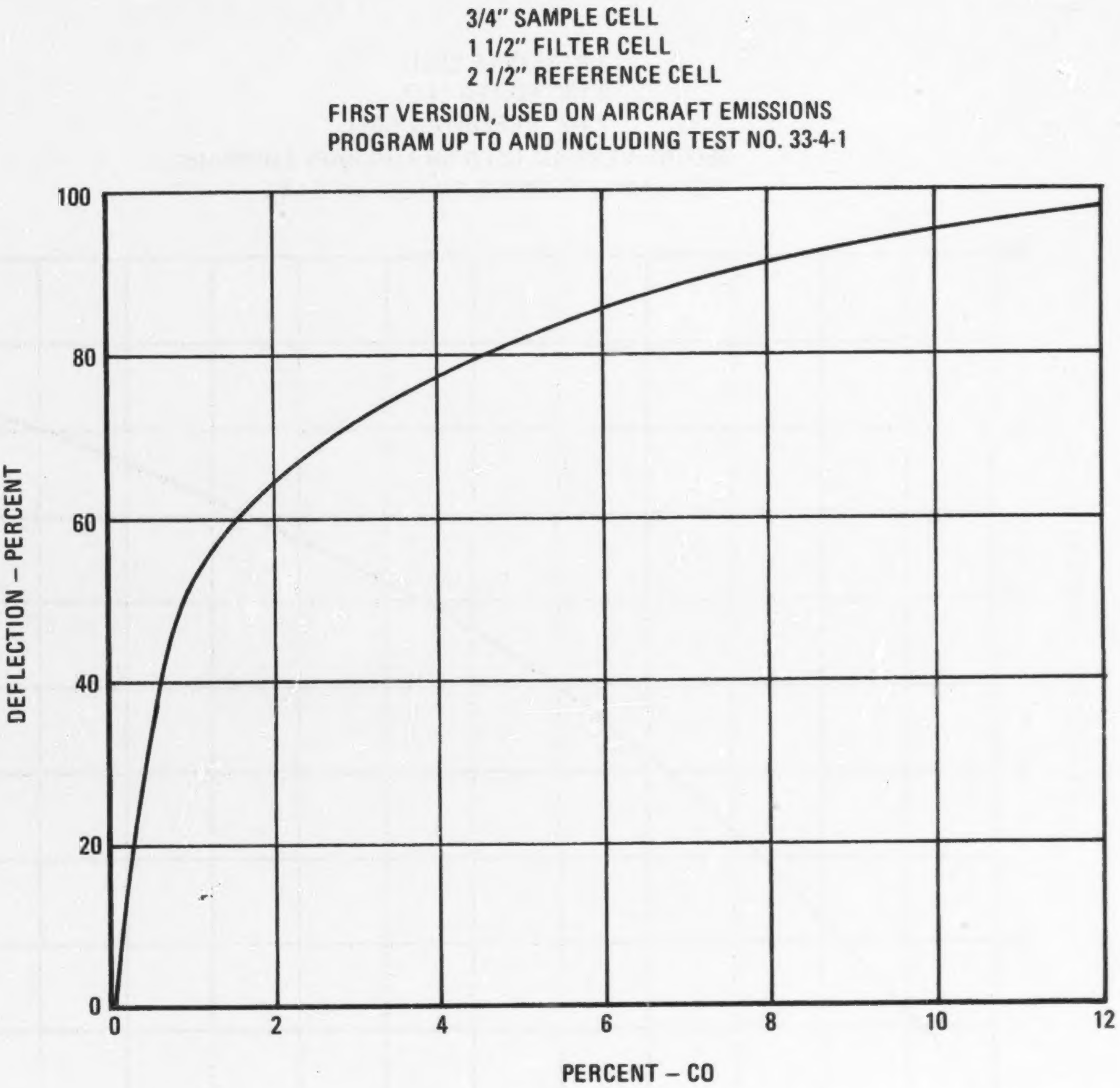


Figure B-3 CO Detector, Calibration
Range 1

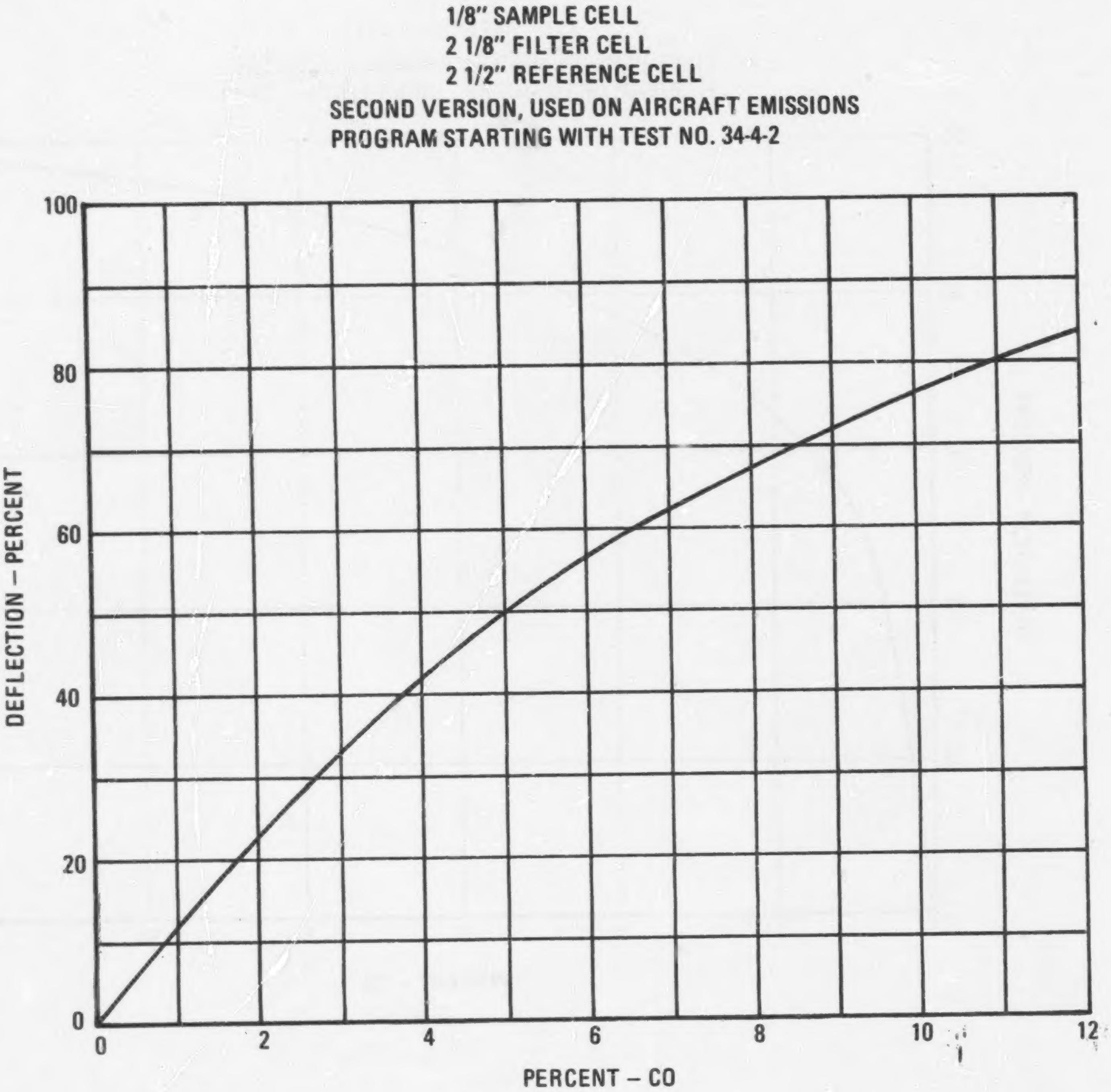


Figure B-4 CO Detector Calibration, Range 1

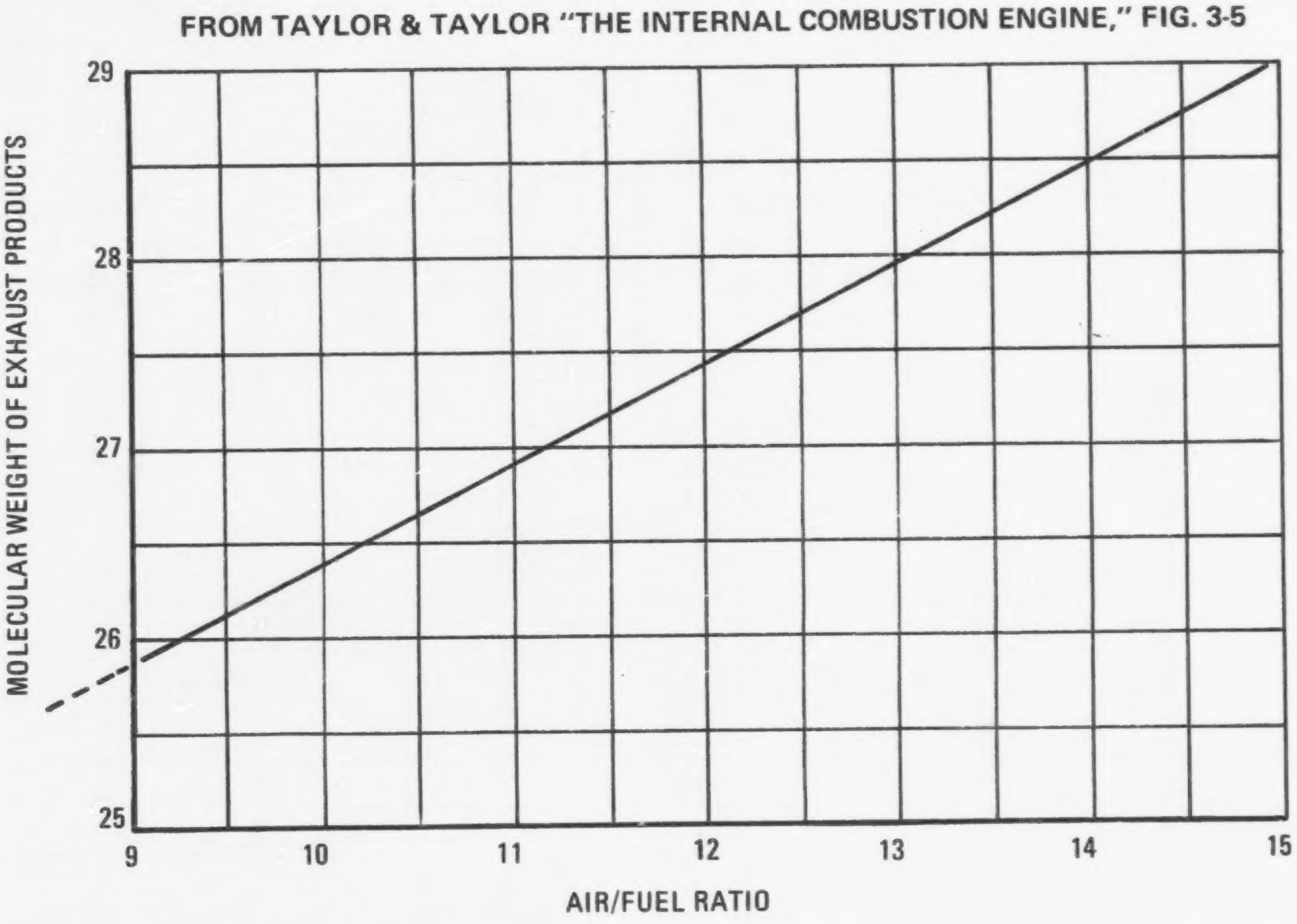


Figure B-5 Molecular Weight of Exhaust Products For Gasoline Engines Running with A/F Ratios Richer Than Stoichiometric

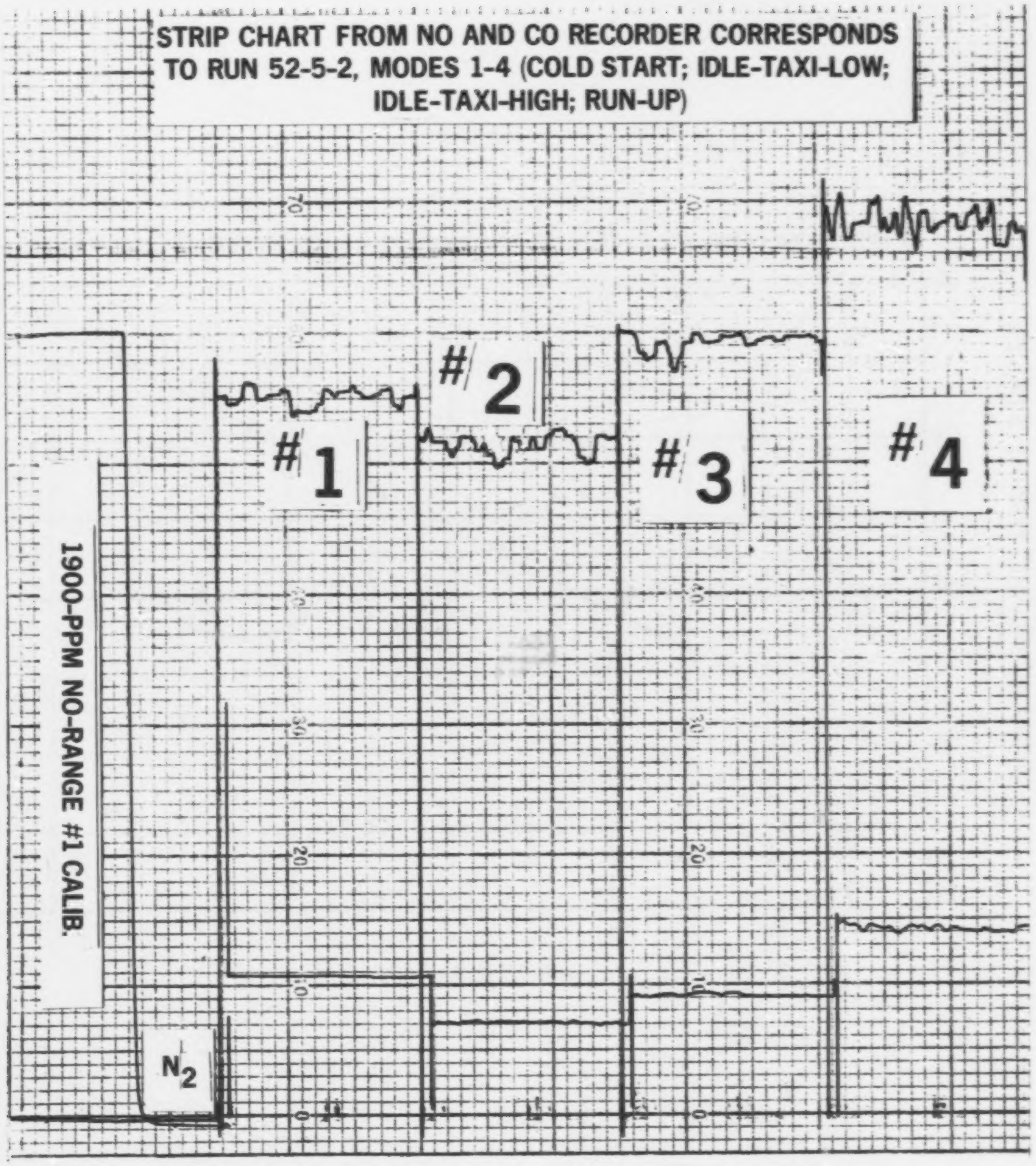
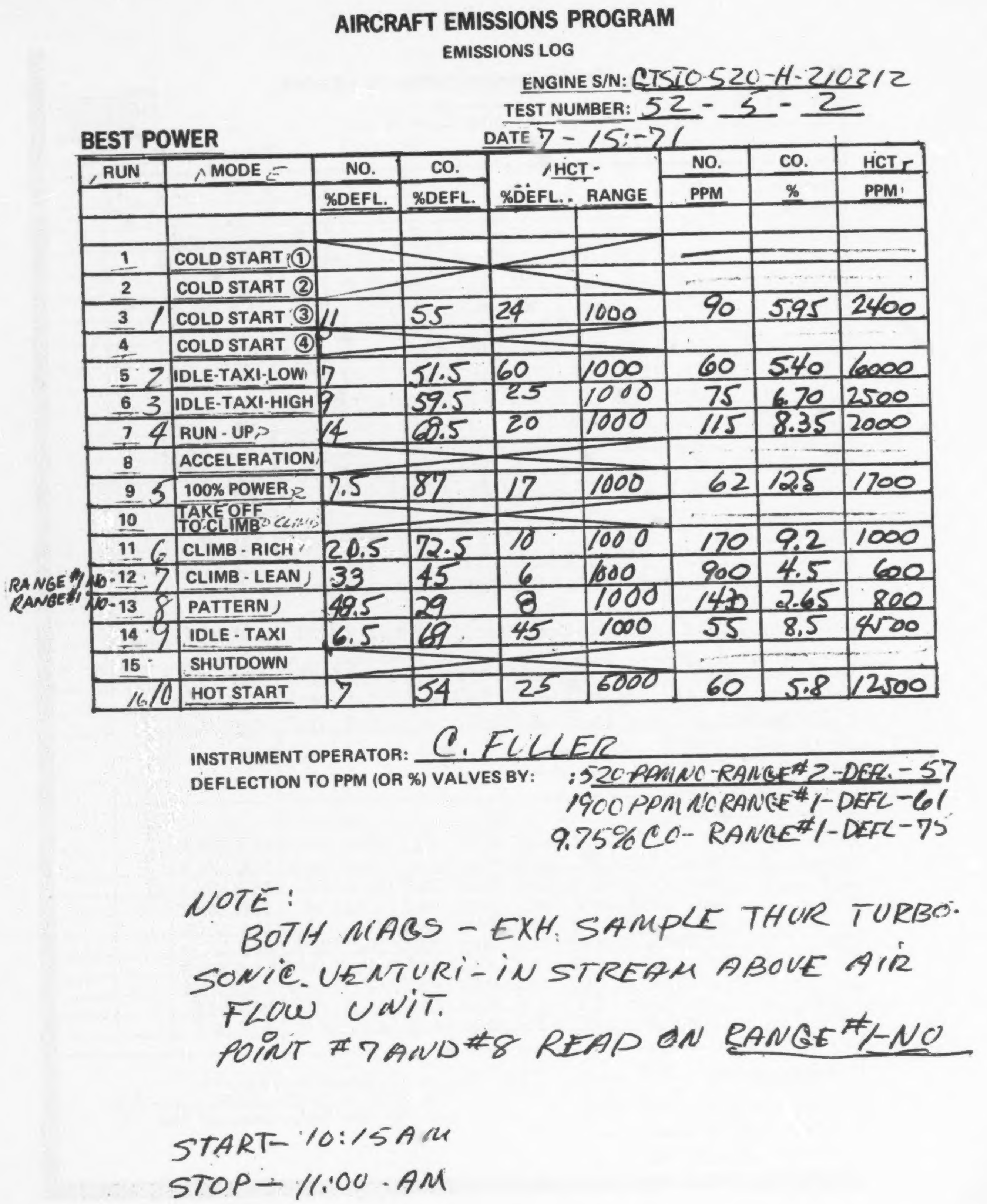


Figure B-6 Strip Chart from NO and CO Recorder



AIRCRAFT EMISSIONS PROGRAM

EMISSIONS LOG

ENGINE S/N: GTSIO-520-H-210212

TEST NUMBER: 52 - 5 - 2

BEST POWER

DATE 7 - 15 - 71

RUN	MODE	NO.	CO.	HCT		NO.	CO.	HCT
		%DEFL.	%DEFL.	%DEFL.	RANGE	PPM	%	PPM
1	COLD START ①							
2	COLD START ②							
3 1	COLD START ③	11	55	24	1000	90	5.95	2400
4	COLD START ④							
5 2	IDLE-TAXI-LOW	7	51.5	60	1000	60	5.40	6000
6 3	IDLE-TAXI-HIGH	9	59.5	25	1000	75	6.70	2500
7 4	RUN - UP	14	68.5	20	1000	115	8.35	2000
8	ACCELERATION							
9 5	100% POWER	7.5	87	17	1000	62	12.5	1700
10	TAKE OFF TO CLIMB							
11 6	CLIMB - RICH	20.5	72.5	10	1000	170	9.2	1000
RANGE #1 NO - 12 7	CLIMB - LEAN	33	45	6	1000	900	4.5	600
RANGE #1 NO - 13 8	PATTERN	48.5	29	8	1000	140	2.65	800
14 9	IDLE - TAXI	6.5	69	45	1000	55	8.5	4500
15	SHUTDOWN							
16 10	HOT START	7	54	25	6000	60	5.8	12500

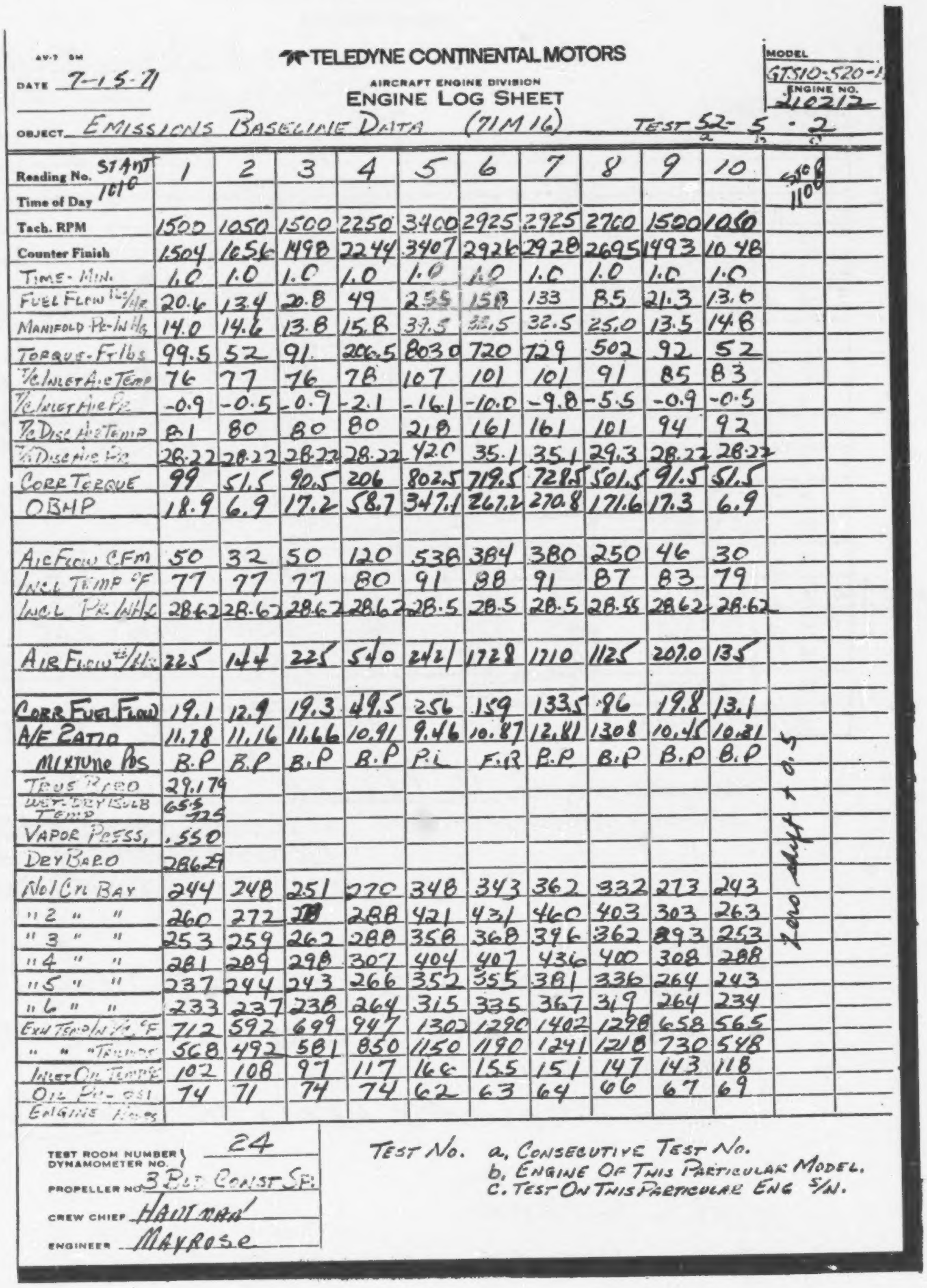
INSTRUMENT OPERATOR: C. FULLER

DEFLECTION TO PPM (OR %) VALVES BY: 520 PPM NO - RANGE #2 - DEFL. - 57
1900 PPM NO RANGE #1 - DEFL - 61
9.75% CO - RANGE #1 - DEFL - 75

NOTE:
BOTH MAGS - EXH. SAMPLE THUR TURBO.
SONIC VENTURI - IN STREAM ABOVE AIR
FLOW UNIT.
POINT #7 AND #8 READ ON RANGE #1 - NO

START - 10:15 AM
STOP - 11:00 AM

Figure B-7 Emissions Program Log Sheet



AV-7 5M

TELEDYNE CONTINENTAL MOTORS

AIRCRAFT ENGINE DIVISION

ENGINE LOG SHEET

DATE 7-15-71

MODEL GTSIO-520-

ENGINE NO. 210212

OBJECT EMISSIONS BASELINE DATA (71M16) TEST 52- 5 - 2 (a, b, c)

Reading No. START	1	2	3	4	5	6	7	8	9	10	Stop 1100	
Time of Day 1010												
Tach. RPM	1500	1050	1500	2250	3400	2925	2925	2760	1500	1050		
Counter Finish	1504	1056	1498	2244	3407	2926	2928	2695	1493	1048		
TIME - MIN.	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0		
FUEL FLOW Lb/Hr	20.6	13.4	20.8	49	255	158	133	85	21.3	13.6		
MANIFOLD Pr-IN Hg	14.0	14.6	13.8	15.8	37.5	32.5	32.5	25.0	13.5	14.8		
TORQUE - Ft lbs	99.5	52	91	206.5	803.0	720	729	502	92	52		
T/C INLET AIR TEMP	76	77	76	78	107	101	101	91	85	83		
T/C INLET AIR PR	-0.9	-0.5	-0.9	-2.1	-16.1	-10.0	-9.8	-5.5	-0.9	-0.5		
T/C DISC AIR TEMP	81	80	80	80	218	161	161	101	94	92		
T/C DISC AIR PR	28.22	28.22	28.22	28.22	42.0	35.1	35.1	29.3	28.22	28.22		
CORR TORQUE	99	51.5	90.5	206	802.5	719.5	728.5	501.5	91.5	51.5		
OBHP	18.9	6.9	17.2	58.7	347.1	267.2	270.8	171.6	17.3	6.9		
AIR FLOW CFM	50	32	50	120	538	384	380	250	46	30		
INCL TEMP °F	77	77	77	80	91	88	91	87	83	79		
INCL PR IN Hg	28.62	28.62	28.62	28.62	28.5	28.5	28.5	28.55	28.62	28.62		
AIR FLOW Lb/Hr	225	144	225	540	2421	1728	1710	1125	207.0	135		
CORR FUEL FLOW	19.1	12.9	19.3	49.5	256	159	133.5	86	19.8	13.1		
A/F RATIO	11.78	11.16	11.66	10.91	9.46	10.87	12.81	1308	10.45	10.81	Zero shift + 0.5	
MIXTURE POS	B.P	B.P	B.P	B.P	P.L	F.R	B.P	B.P	B.P	B.P		
TRUE BARO	29.179											
WET-DRY BULB TEMP	65.5 72.5											
VAPOR PRESS.	.550											
DRY BARO	28.629											
No 1 CYL BAY	244	248	251	270	348	343	362	332	273	243		
" 2 " "	260	272	278	288	421	431	460	403	303	263		
" 3 " "	253	259	262	288	358	368	396	362	293	253		
" 4 " "	281	289	298	307	404	407	436	400	308	288		
" 5 " "	237	244	243	266	352	355	381	336	264	243		
" 6 " "	233	237	238	264	315	335	367	319	264	234		
EXH TEMP IN °F	712	592	699	947	1302	1290	1402	1298	658	565		
" " "[illegible]"	568	492	581	850	1150	1190	1241	1218	730	548		
INLET OIL TEMP °F	102	108	97	117	166	155	151	147	143	118		
OIL PR - PSI	74	71	74	74	62	63	64	66	67	69		
ENGINE HOURS												

TEST ROOM NUMBER / DYNAMOMETER NO. 24

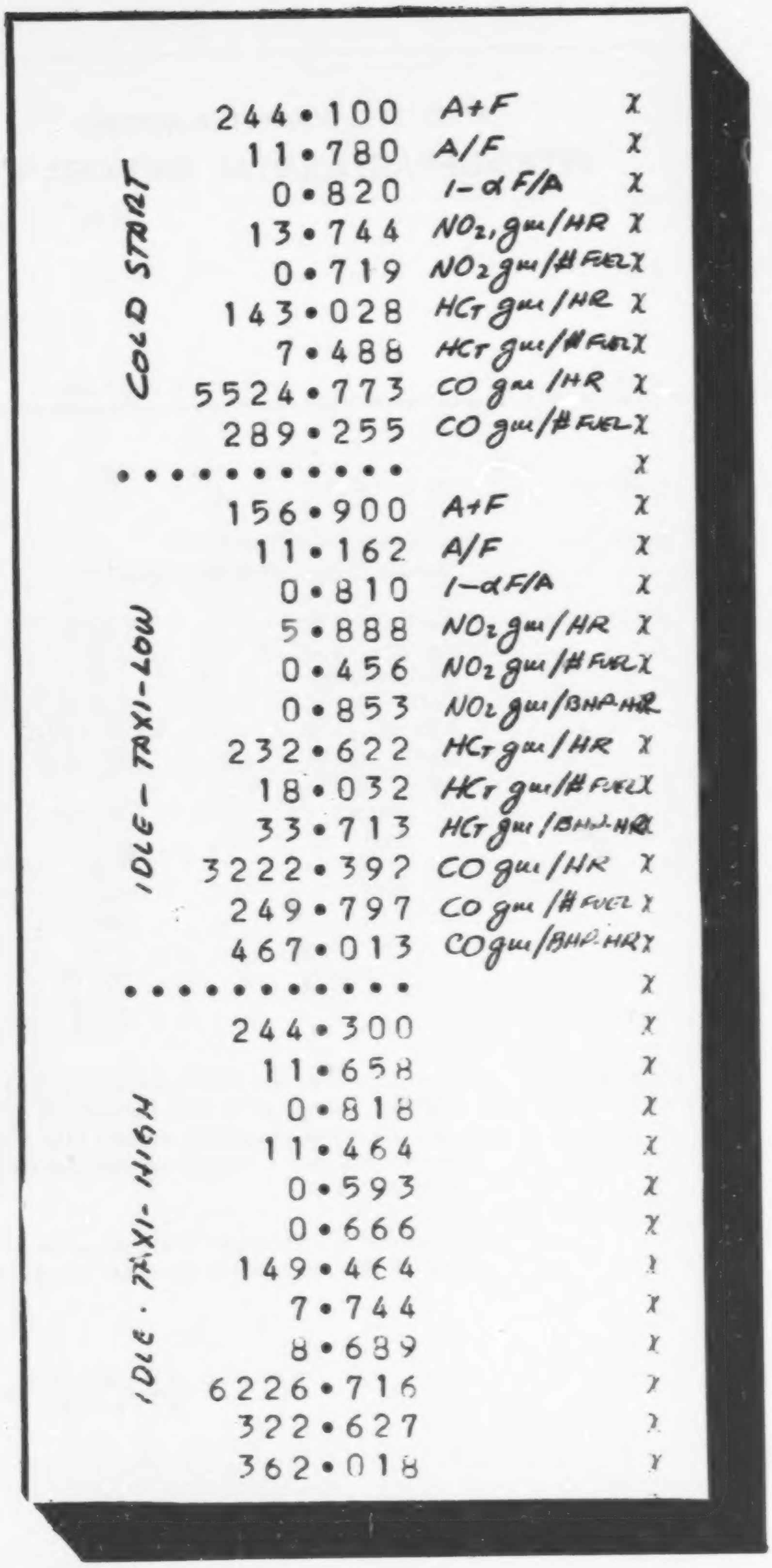
PROPELLER NO. 3 BLD CONST SP.

CREW CHIEF HAITMAN

ENGINEER MAYROSE

TEST No. a. CONSECUTIVE TEST No.
b. ENGINE OF THIS PARTICULAR MODEL.
c. TEST ON THIS PARTICULAR ENG S/N.

Figure B-8 Engine Log Sheet



COLD START

```
 244•100 A+F           X
  11•780 A/F           X
   0•820 1-αF/A        X
  13•744 NO2,gm/HR     X
   0•719 NO2gm/#FUELX
 143•028 HCT gm/HR     X
   7•488 HCT gm/#FUELX
5524•773 CO gm/HR      X
 289•255 CO gm/#FUELX
•••••••••••            X
```

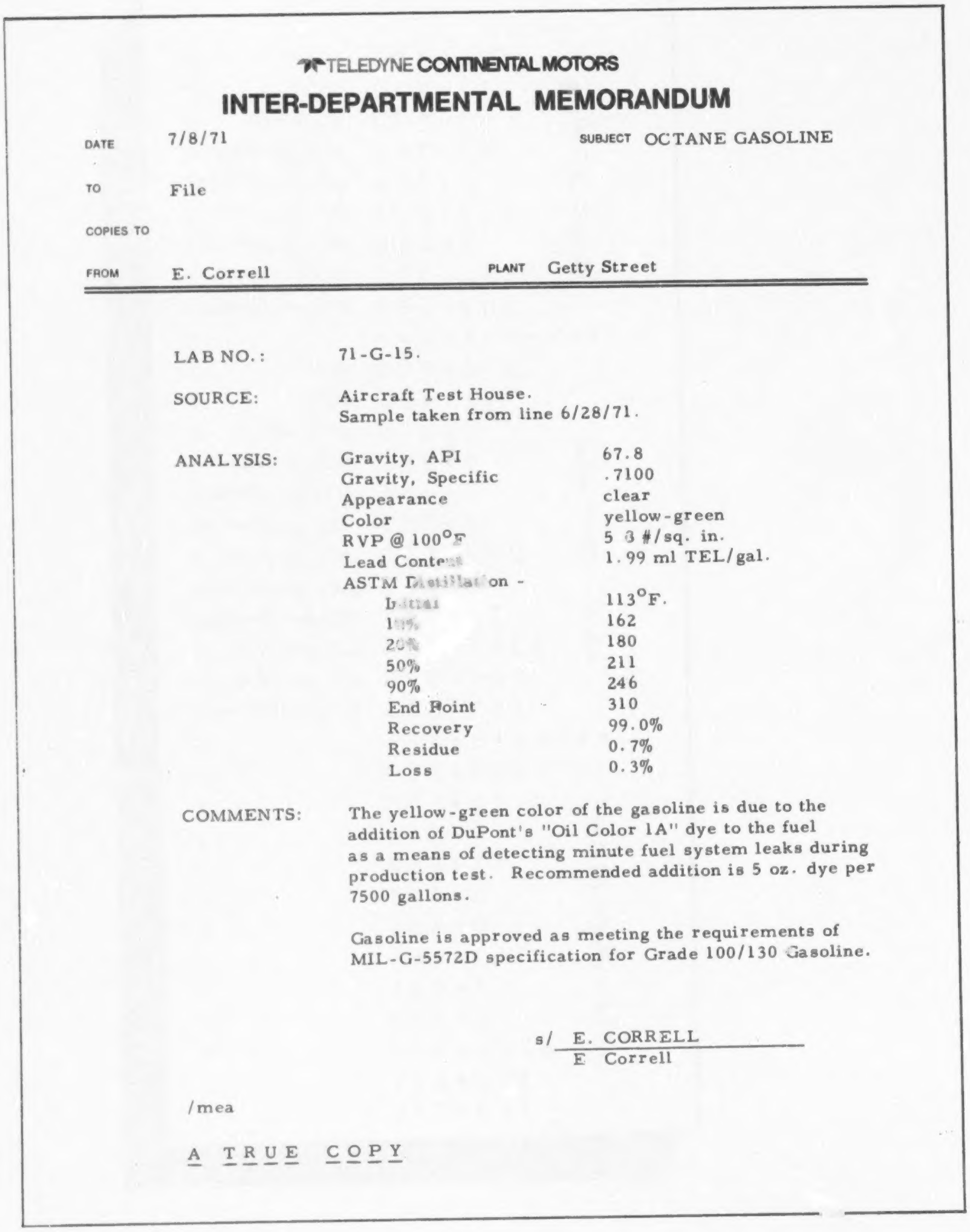
IDLE - TAXI-LOW

```
 156•900 A+F           X
  11•162 A/F           X
   0•810 1-αF/A        X
   5•888 NO2gm/HR      X
   0•456 NO2gm/#FUELX
   0•853 NO2gm/BHP·HR
 232•622 HCTgm/HR      X
  18•032 HCT gm/#FUELX
  33•713 HCT gm/BHP·HR
3222•397 CO gm/HR      X
 249•797 CO gm/#FUEL X
 467•013 COgm/BHP·HRX
•••••••••••            X
```

IDLE · TAXI- HIGH

```
 244•300               X
  11•658               X
   0•818               X
  11•464               X
   0•593               X
   0•666               X
 149•464               X
   7•744               X
   8•689               X
6226•716               X
 322•627               X
 362•018               X
```

Figure B-9 Section of Calculations Print-Out Tape (Corresponds to Run 52-5-2 Modes 1-3).



TELEDYNE CONTINENTAL MOTORS

INTER-DEPARTMENTAL MEMORANDUM

DATE 7/8/71 SUBJECT OCTANE GASOLINE

TO File

COPIES TO

FROM E. Correll PLANT Getty Street

LAB NO.: 71-G-15.

SOURCE: Aircraft Test House.
Sample taken from line 6/28/71.

ANALYSIS:	Gravity, API	67.8
	Gravity, Specific	.7100
	Appearance	clear
	Color	yellow-green
	RVP @ 100°F	5.3 #/sq. in.
	Lead Content	1.99 ml TEL/gal.
	ASTM Distillation -	
	Initial	113°F.
	10%	162
	20%	180
	50%	211
	90%	246
	End Point	310
	Recovery	99.0%
	Residue	0.7%
	Loss	0.3%

COMMENTS: The yellow-green color of the gasoline is due to the addition of DuPont's "Oil Color 1A" dye to the fuel as a means of detecting minute fuel system leaks during production test. Recommended addition is 5 oz. dye per 7500 gallons.

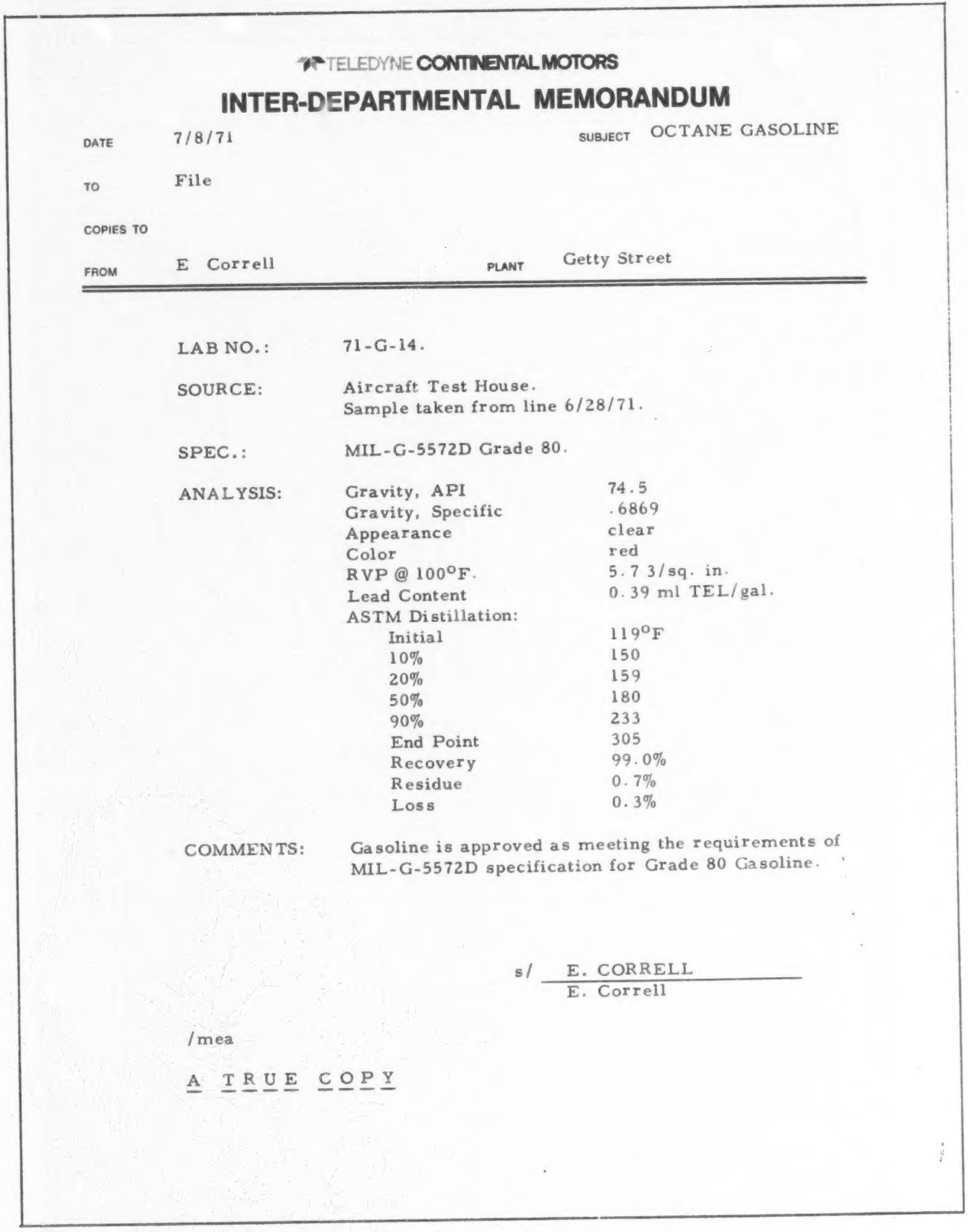
Gasoline is approved as meeting the requirements of MIL-G-5572D specification for Grade 100/130 Gasoline.

s/ E. CORRELL
E Correll

/mea

A TRUE COPY

Figure B-10 Laboratory Test Report 71-G-15



TELEDYNE CONTINENTAL MOTORS

INTER-DEPARTMENTAL MEMORANDUM

DATE 7/8/71
SUBJECT OCTANE GASOLINE
TO File
COPIES TO
FROM E Correll
PLANT Getty Street

LAB NO.: 71-G-14.

SOURCE: Aircraft Test House.
Sample taken from line 6/28/71.

SPEC.: MIL-G-5572D Grade 80.

ANALYSIS:	Gravity, API	74.5
	Gravity, Specific	.6869
	Appearance	clear
	Color	red
	RVP @ 100°F.	5.7 3/sq. in.
	Lead Content	0.39 ml TEL/gal.
	ASTM Distillation:	
	Initial	119°F
	10%	150
	20%	159
	50%	180
	90%	233
	End Point	305
	Recovery	99.0%
	Residue	0.7%
	Loss	0.3%

COMMENTS: Gasoline is approved as meeting the requirements of MIL-G-5572D specification for Grade 80 Gasoline.

s/ E. CORRELL
E. Correll

/mea

A TRUE COPY

Figure B-11 Laboratory Test Report 71-G-14

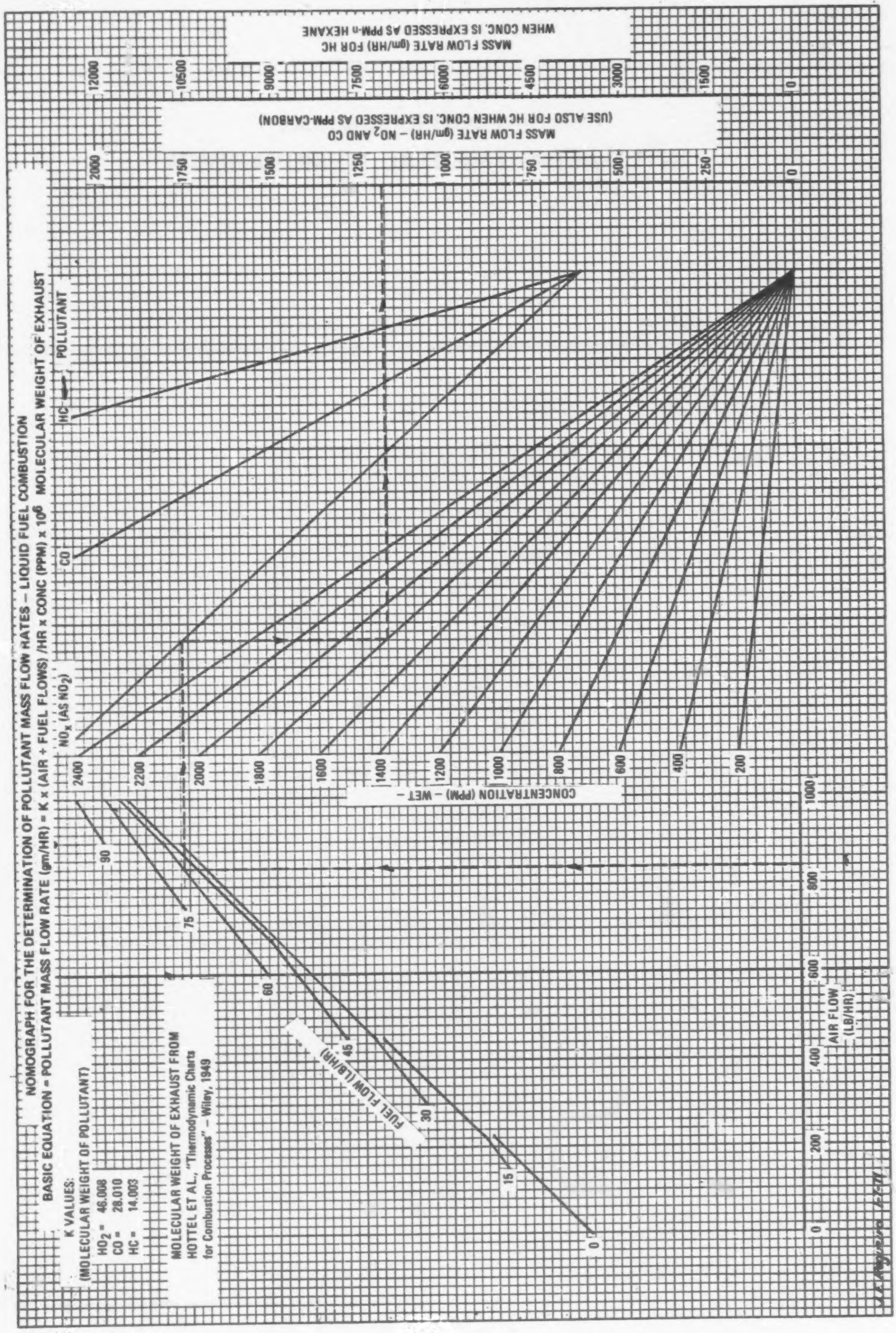


Figure B-12 Mass Flow Rate Determination Nomograph.

TABLE I
Span Gas Cross Check

Cylinder #	EPA	Allison	Contin- ental	P&W	Scott Norfolk	Scott Allentown
A-247 Hydrocarbon (ppm, propane)	71(±1)	60(±1)	-----	57.3(±2)	68.1(±1)	-----
13359-B Hydrocarbon (ppm, propane)	10.7(±.5)	7.5(±.5)	-----	9.0(±.5)	9.7(±.5)	-----
A-6775 CO (ppm)	83(±20)	101(±2)	-----	93(±5)	101(±5)	-----
A-672 CO (ppm) CO_2 (%)	500(±25) 1.57(±.05)	565(±?) 1.68(±?)	----- -----	515(±20) 1.55(±.03)	530(±20) 1.58(±.03)	----- -----
A-6741 CO_2 (%)	4.2(±.05)	4.5(±.05)	-----	4.16(±.05)	4.28(±.03)	-----
A-2334 NO (ppm)	85(±1)**	87(±3)* 89.5(±2)**	----- -----	78(±3)*	81.6(±2)** 67.5(±5)*	----- -----
SSB-162 NO (ppm)	20.5(±1)**	21(±3)* 20(±2)**	----- -----	19.5(±3)*	19(±2)** 13(±3)*	----- -----
1-15738 NO (ppm)	1240(±50)**	-----	1140(±100)*	-----	-----	1250(±50)**
A-1905 CO (%)	1.56(±.03)	-----	1.5(±.03)	-----	-----	1.5(±.2)
1-4523 Hydrocarbon (ppm, propane)	1110(±20)	-----	1060(±20)	-----	-----	1024(±20)
FF-17054 CO (%) CO_2 HC (ppm, propane)	3.99(±.15) 7.64(±.2) 731(±30)	----- ----- -----	3.95(±.05) ----- 700(±30)	----- ----- -----	----- ----- -----	4.2(±.2) 7.7(±.2) 695(±30)

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Table B-1 Results of E. P. A. Tests on Unknown Gases.